# NATURE

No. 3810 SATURDAY, NOV. 7, 1942 Vol. 150


## CONTENTS


| | Page |
|---|---|
| Venereal Diseases : a Sociological Problem | 529 |
| The Manuscripts of C. W. Scheele. By Prof. James Kendall, F.R.S. | 532 |
| Photographic Identification of Timbers. By Dr. C. R. Metcalfe | 533 |
| Hydrogen Ions in Pure and Industrial Chemistry. By Prof. H. L. Riley | 534 |
| Darwin Manuscripts and Letters | 535 |
| Effects of Clothing and Fuel Shortage on Health. By Sir Leonard Hill, F.R.S. | 536 |
| National Flour and Bread. From the Scientific Adviser's Division, Ministry of Food | 538 |
| Mineral Resources of the U.S.S.R. By Dr. David Williams | 539 |
| Obituaries : | |
| Prof. A. Ukhtomsky | 541 |
| Prof. K. N. Moss, O.B.E. By Dr. G. A. Shakespear | 542 |
| News and Views | 542 |
| Letters to the Editors : | |
| Scaliness of Animal Fibres.—N. H. Chamberlain and Prof. J. B. Speakman | 546 |
| Vitamin Requirement of the American Flour Beetle *Tribolium confusum* Duval.—H. Rosenthal and T. Reichstein | 546 |
| Demonstration of the Telophase Split in Todea. —Dr. I. Manton | 547 |
| A Water-soluble Carcinogen Derived from 3 : 4-Benzpyrene.—Dr. C. B. Allsopp | 548 |
| Lichenin.—Dr. E. G. V. Percival and H. Granichstädten | 549 |
| Artificially Induced Loss of Theta-Toxin Production by *Clostridium welchii* Types A and C.—Dr. A. W. Turner, Catharine Eales and A. W. Rodwell | 549 |
| The E.M.F. of Thermal Fluctuations in Resistances. —L.-V. M. Surdin, F.F.N. | 550 |
| Energy-level Treatment of Reaction Data.—Dr. J. W. Baker | 551 |
| Agricultural Research Institutes and the Future.—Prof. G. W. Robinson | 551 |
| Research Items | 552 |
| Earthquakes in New Zealand | 554 |
| Social Biology in Education | 555 |
| Plankton of the North Sea | 555 |



*Editorial and Publishing Offices*
MACMILLAN & CO., LTD.,
ST. MARTIN'S STREET, LONDON, W.C.2.
Telephone Number: Whitehall 8831
Telegrams: Phusis Lesquare London

*Advertisements should be addressed to*
T. G. Scott & Son, Ltd., Talbot House, 9 Arundel Street, London, W.C.2
Telephone: Temple Bar 1942

The annual subscription rate is £4 10 0, payable in advance, Inland or Abroad.


All rights reserved. Registered as a Newspaper at the General Post Office


## VENEREAL DISEASES: A SOCIOLOGICAL PROBLEM

THE Government is concerned about the present increase in venereal diseases throughout Great Britain. While the majority of us outside the medical profession, and quite a number of medical men themselves, treat the subject as we do, that is, taboo, the announcement that such an increase is taking place is no occasion for surprise; for, by implication alone, that is, without data, we are bound to conclude that with the present war-time change in conditions, accompanied by scarcely any change in the general attitude towards venereal disease as a social problem of the first magnitude, the whole problem is almost certain to loom up as a challenge to public health, leaving us concerned and confused.

Let us now look at the data as recently presented by Sir Wilson Jameson, chief medical officer of the Ministry of Health. Before the War, venereal disease in Great Britain was steadily decreasing; in fact, hitherto, compared with other countries, we had a very good record. In 1931, more than 9,000 cases of syphilis contracted during the year attended clinics in England and Wales. In 1939 this figure had fallen to about 5,000—a record reflecting credit on the medical research and services of the country. Last year, the number of new infections of syphilis among the civilian population treated at clinics (to which the great bulk of cases of syphilis go for treatment) was 7,332. The number of new cases of gonorrhœa is not known precisely because quite an appreciable number are treated by private medical practitioners, and venereal diseases are not notifiable. Roughly speaking, however, there are eight new infections of gonorrhœa to every one of syphilis. Therefore there was a total of nearly 70,000 new venereal infections among civilians last year. There were 5,000 cases of syphilis infection among civilians in 1939, 5,600 in 1940 and 7,300 in 1941. If to this be added the infections in the Services, there has been an increase of about 70 per cent infections in Great Britain since the War began. This need not necessarily give cause for alarm, because a certain increase is inevitable in present conditions. But it does present food for thought. Are we as a community approaching the problem at the right angle? Is not the long-distance view the better one to take in this case?

It is a matter for reflection that many men of science might immediately respond: 'What has this to do with us? It is the concern of our medical colleagues.' On closer consideration, however, we must admit that it is not only a matter for the concern of men of science, especially biologists and educationists, but also it is all the more serious because so many men of science are ignoring this fact. The whole problem is a sociological one of the first magnitude, and might well become more serious unless more public-spirited people help to grapple with it. It is useless to adopt, as we have tended to do in the past, a policy of *laisser-faire*, and it is certainly

neither fair nor wise to leave it to the Government, for many members of this or any other Government of the past probably need as much enlightenment as the rest of us. It is undoubtedly a problem for Government, local authorities, Church, medical men, men of science, educationists and others, all working together in enlightened harmony.

Here we are concerned only with men of science—especially biologists and educationists. What have they done and what are they doing to meet a situation which has really been facing us for years, though now in a more acute form, as is usual in war-time? Medicine offers much, and, in fact, is probably doing as much as can be expected of it. Sir Wilson Jameson has revealed that in England and Wales there are two hundred treatment centres, mostly at hospitals, with skilled staffs and equipment. More treatment facilities have been set up to meet war-time contingencies. If everyone who contracts one of these venereal diseases would only seek skilled treatment at the earliest possible stage, and continue it, *the problem would be reduced to manageable proportions within a few months.*

Can we ask much more than this of the medical men? Being the men on the job, they must inevitably realize the seriousness of the problem. This has been so since long before the War. But even the medical men have been too prone to look upon the problem rather as an exclusively medical, or we might say, technical one. Now they are beginning to realize that the whole question must be considered from more angles than that of physic or public health. The Central Council for Health Education*, which is composed almost entirely of public-spirited medical men, under the chairmanship of Dr. C. Hill, the capable and energetic deputy secretary of the British Medical Association, and inspired by the presidency of no less a social leader than the Archbishop of Canterbury, is attacking the whole issue as a sociological problem of the utmost importance. Lectures throughout the country by an authoritative and well-trained staff, films and pamphlets on health subjects (paying special attention to venereal disease) all come within the ambit of the Central Council, which works in close liaison with the Ministry of Health. Thus are medical men courageously tackling, in a manner which brooks little criticism, a problem which otherwise might well seriously undermine the physical, mental and moral health of the country.

But this War, like the last though even more so, has brought into the limelight a serious sociological defect that has really been evident to those who would see for a very long time. We, as men of science, may leave it to the Ministry of Health, the Central Council for Health Education, and other authorities to deal with the exceptional and very difficult health problems which have become intensified in a country at war. But what of the future? Is it fair to leave it all to the medical profession? And do the majority of medical men themselves realize what is the fundamental root of the entire problem? Are medical men and their organizations responsible for the deplorable state of the country (and indeed the whole world) so far as venereal disease is concerned? If we refer back to the claim that the whole problem "would be reduced to manageable proportions within a few months", we must give a negative reply to all these questions.

It is the opinion of the Ministry of Health that the first requirement in combating the spread of venereal disease is 'open discussion'. This seems very reasonable, for here we have local authorities and their medical organizations, institutes, advisers and practitioners, offering free and confidential treatment, yet the whole of this valuable social service is handicapped by what Sir Wilson Jameson calls "this misguided secrecy". "Because of an old tradition of 'hush-hush' on the matter, the public does not know what it ought to know." It is not a question of the knowledge at the disposal of the medical profession, but more a problem of the application to society of already well-known discoveries. There is no need to make any startlingly new medical discoveries; *we have the information needed to deal with venereal diseases.*

Clearly there is something very wrong with a community which is suffering from a blot on its public health system, has the wherewithal for erasing it, yet fails to do so. Educationists and men of science—especially biologists—must be aware of the difficulties of their medical colleagues; they must therefore show their awareness and come forward and do their share more openly. The public must be informed, of course; but there lies the difficulty. The 'hush-hush' tradition is an intolerable handicap; this "misguided secrecy" is a ludicrous, almost Gilbertian, blockade to progress. A medical practitioner can discuss the most intimate details of a case of pregnancy with a woman and still remain a gentleman; why cannot he be given the same chance in this connexion?

Much is due to *laisser-faire*, much to the ignorance of those who in any event never appeal to medicine or science until something goes wrong—and sometimes not even then; but one major cause of the difficulty can be ascribed to those present-day people who resent open discussion (consequently public enlightenment) of a quite understandable problem. Venereal disease can scarcely be claimed to be a topic for the drawing-room, but then neither are cancer, tuberculosis, or even nutrition, except perhaps war-time food rationing. Therefore, whether those members of the community who pursue the policy of the ostrich or the hypocrite are to be appeased or ignored is a matter for the State authorities. As Sir Wilson Jameson has said, we shall never combat and eventually bring this scourge under control by running away from it, by shutting our eyes to its existence, by refusing to discuss it, or by withholding from young people information regarding its dangers. We have the knowledge and the facilities we need. Early diagnosis and early skilled treatment are available, and everyone should be made aware of the prevalence of venereal disease, how it is contracted and how it can be cured. There must be no more secrecy.

The fact that the State is in this quandary is one of general, and therefore much wider, responsi-

* Tavistock House, Tavistock Square, London, W.C.1.

bility. It is surely a matter of education—general education. If the ordinary man had developed, through the formal education of his earlier years, the correct frame of mind and a rational attitude towards life, it would be possible to discuss with him the seriousness of venereal disease as easily and frankly as it is to warn him against sneezing in public. To over-ride all this should be the ultimate, and therefore fundamentally the most important aim, in the whole problem; the immediate aim—curing of those afflicted—is the concern of medical men. If the educationist gave his charges the best and most liberal education, he would hand over to society broad-minded, rational citizens who would give no special concern to health authorities so far as venereal or indeed other diseases are concerned. This is not to suggest that the subject of venereal disease should ever be discussed or even mentioned in our schools; it would be a sad day if and when this ever became necessary.

Most medical men and many other biologists can discuss with their colleagues the problems involved in connexion with venereal disease without turning a hair, but they could not do so without an acute feeling of embarrassment with non-biologists, nor indeed with many who have had a certain amount of biological training. Here, therefore, lies a strong argument in favour of every child being given a broad biological background during his school years, and this should begin long before he personally attains physical sexual maturity. During any complete survey of the field of biology in our schools, the elements of human reproduction should receive consideration in their logical place in the scheme of the curriculum. Human reproduction should not be left, as it so often is, to implication from the study of reproduction in the rabbit or the frog. By this, we do not for one moment suggest that sex should be emphasized in any way, and certainly venereal disease should never be considered, any more than a teacher would discuss in school the details of an operation for appendicitis. The general concepts of healthy living would, however, inevitably find a place in the curriculum. If a man or woman had been correctly trained in the elements of general biology, then discussion of venereal disease in later life (if it arose out of necessity as it has now) would not give cause for embarrassment, and it surely would never have to take place, metaphorically speaking, behind closed doors, though, for many obvious reasons, a certain amount of secrecy in each individual case is desirable.

Many of our medical men realize all this. For the first time, on October 23, Sir Wilson Jameson broadcast a thoughtful and well-balanced talk through the B.B.C. to the British public on the questions of tuberculosis and venereal disease. So also is the Central Council for Health Education acting vigorously. This Council is taking both the immediate and long-distance view. For the latter reason, the Council has established an Educational Advisory Committee. Let it be said at once that this Committee is not concerned especially with the problems of venereal disease. It is composed of well-known educationists and representatives of educational organizations, biologists and medical men, and its main function is to advise the Central Council on questions of general biological teaching, but with special reference to healthy living. Sex, and certainly venereal disease, are never specially picked out during its deliberations; in fact, there is not one specialist in venereology among its medical members. Its function is, through the machinery of the parent body, to assist, advise and criticize wherever necessary, so that there may eventually be established throughout Great Britain a better and more balanced training in biological principles, chiefly in the schools. Though the Committee is in no way influenced by the Board of Education, the Board is represented at it. The Ministries of Health and Food also send observers. The Committee feels that through its efforts, with others, in the years to come our citizens will attain a sense of real values and will better be able to face squarely and fearlessly any problems of public health, well-being and progress which may arise.

The present rise in incidence of venereal disease is, as in the past, mainly the result of the absence in our men and women of a biological attitude towards, and an informed view of, life. It is partially the results of faulty training in the schools. The same can be said of nutrition and other aspects of human biology. It is impossible to teach and guide the public completely and satisfactorily because of this ill-informed attitude of the public itself. If our men and women were more cognizant of the facts of the human body and human relations, they would develop a more positive attitude towards human ailments and frailties, and the negative influence of other drawbacks in our society would then largely be eliminated. If our citizens of to-morrow are given a broad outlook in biology, then many of our sociological defects, such as venereal disease, the pernicious influence of quack medicines, malnutrition, the lack of physical training, and so forth, will either disappear entirely or at any rate will not be aggravated by the evil influence of 'hush-hush', or allowed to exist because of ignorance on the part of the general public; further, they will be brought into a sane field of vision and action.

As things are, one Government after another finds itself faced with the need for legislation and organization of many factors concerning public well-being which should never arise. As Sir John Orr, one of the members of the Educational Advisory Committee, claims, malnutrition is one of the major issues of national and international policy and will become even more so. The same may be said of other aspects of public health. Once educationists in general, and biologists in particular, have got down to their duties more in keeping with up-to-date principles of education, then we shall be well on the road towards that desirable goal where we can naturally and sanely consider *all* problems of human biology and sociology in open discussion, and thus set in motion the machinery for combating the enemies of individual and public health and social progress—machinery meticulously constructed by medical, scientific and educational research and oiled by public sympathy, goodwill and confidence.

# THE MANUSCRIPTS OF C. W. SCHEELE

**Carl Wilhelm Scheele**

Manuskript 1756–1777. Tolkning av C. W. Oseen. Pp. vi+173. Manuskript 1756–1777. Ordnade av C. W. Oseen. Ljustryck. Pp. v+182. (Stockholm: K. Svenska Vetenskapsakademien, 1942.)

JUST as Edmund Spenser is called 'the poet's poet', so Carl Wilhelm Scheele merits the title of 'the chemist's chemist'. Lacking all formal training in science, he was instinctively the perfect investigator. In experimental technique, Campbell Brown has remarked in his "History of Chemistry", Scheele has never been surpassed. "His discoveries were the result of carefully planned series of experiments, and he left nothing in doubt where experiment could decide it. He is a model to all who are engaged in chemical research."

Born in 1742 at Stralsund, the chief town of what was at that date Swedish Pomerania, Scheele was apprenticed to an apothecary in Gothenburg at the age of fourteen and spent practically the rest of his all-too-short career—he died at Köping in 1786—as a pharmacist in Sweden. Struggling always against poverty and ill-health, he planned and performed his chemical experiments day after day and year after year in the isolation of provincial shop-laboratories, knowing little (except through correspondence) about the work of his contemporaries in other countries and remaining himself almost completely unrecognized until 1777, when he published his "Chemical Treatise on Air and Fire". He literally lived for his research work, as may be seen by an extract from a letter which he wrote to his friend Gahn in 1775:

"Oh, how happy I am! No care for eating or drinking or dwelling, no care for my pharmaceutical business, for that is mere play to me. But to watch new phenomena—this is all my desire, and how glad is the enquirer when discovery rewards his diligence; then his heart rejoices."

Among the numerous discoveries which rewarded Scheele's diligence and made his heart rejoice were two of really primary importance—oxygen and chlorine. Priestley, it is true, was the first to announce the discovery of oxygen, and he is commonly given the principal credit therefor, but we know now from Scheele's note-books that he had prepared the element systematically in several different ways prior to the more famous, but comparatively casual, experiments of Priestley in 1774. After Scheele's death, the Royal Swedish Academy of Sciences commissioned its secretary, J. C. Wilcke, to deliver a memorial address, and the manuscripts which Wilcke obtained from Scheele's widow to assist him in the preparation of this address were afterwards deposited in the archives of the Academy. Fifty years ago, certain of these manuscripts were published in a stately volume by A. E. Nordenskiöld: "Carl Wilhelm Scheele. Correspondence and Laboratory Notes" (Stockholm, 1892). As Dr. Leonard Dobbin, in his valuable book, "The Collected Papers of Carl Wilhelm Scheele" (Bell and Sons, 1931), has stated, the introduction to this volume, together with Nordenskiöld's annotations and additional matter, provides a wealth of interesting biographical and other information, much of which is not included in earlier biographies. Nordenskiöld concludes his own biographical sketch with the following paragraph: "The picture which biographers have given of Scheele as an investigator is incomplete. It is only by the aid of the letters and laboratory records here presented that we can obtain a grasp of the insatiable thirst for knowledge which impelled him to separate and to examine in his flasks, retorts and crucibles everything that came into his hands; of the number and importance of his chemical discoveries; of the range of the experiments upon which every communication that appeared in print was based; of the discernment with which even the most inconspicuous phenomena were observed and utilized as guides in the elucidation of new truths; and of Scheele's true significance as a real pioneer of scientific chemistry."

It now appears, however, that Nordenskiöld's picture is itself extremely incomplete. Fru Elin Bergsten, who was entrusted with the task of

CARL WILHELM SCHEELE

The statue stands in Humlegården, one of Stockholm's many beautiful parks. It was modelled by J. Börjeson and unveiled in 1892, in commemoration of the sesquicentenary of Scheele's birth.

deciphering the manuscripts, was a skilful palæographer but no chemist, and had perforce to leave no small portion of their contents unexplained. It is to fill up the extensive gaps in Fru Bergsten's transcriptions that the two volumes here under review are devoted.

The immediate urge for their publication is twofold. First of all, there is the desire of the Royal Swedish Academy of Sciences to celebrate in appropriate manner the bicentenary of Scheele's birth in 1742 (the exact date is December 19). The second factor can best be explained by direct translation from Prof. C. W. Oseen's preface :

"Modern methods of waging war threaten all memorials of civilization with annihilation. No other salvation from this danger is offered to the strongest of such memorials, old buildings, than chance may bring. There is, however, one method of saving the weakest and the most easily destroyed, —the written page : not quite certain, but almost certain. Reproduction of a sufficient number of copies and dissemination of these copies in a sufficient number of different places ensures, with practical certainty, that some one of the copies will escape destruction.

"Have these manuscripts of Carl Wilhelm Scheele such value for the present and future generations that their preservation in a world of destruction can be justified ? The answer is that if these manuscripts can only be correctly dated, then we shall be able to fix the dates of Scheele's discoveries. An attempt in this direction was made by A. E. Nordenskiöld about 1890, but such a task is too much for one man ; it demands the collaboration of all those scientific men who are interested in the subject. To render such collaboration possible is one of the objects of this publication of Scheele's manuscripts.

"Is it, now, so important to know, *when* Scheele made his discoveries ? This publication is based on the assumption that it is important, both for us and for those who will come after us, to know the past, in other words on the assumption that civilisation will persist and not be destroyed."

Therefore Sweden, fortunate enough so far to have escaped the 'crocodile', safeguards the human race against the still imminent wanton destruction of her scientific treasures by presenting these priceless manuscripts to the world at large "in the war-year of 1942". It is a noble project, and it has been nobly accomplished. One of the two volumes comprises 182 pages of beautiful photographic reproductions of the manuscripts themselves, arranged by Prof. Oseen. In the other volume, Prof. Oseen has "decoded" Scheele's crabbed conglomerations of alchemical and pharmaceutical signs, dog-Latin and contracted German, into modern print. How onerous the task was, and how conscientiously and skilfully it has been carried to completion, can be fully appreciated only by careful comparison of corresponding sections.

In thirteen pages of notes at the end of the second volume, Prof. Oseen discusses in a scholarly manner certain of the chronological problems involved, particularly with respect to two of the most important oxygen manuscripts, No. 43 and No. 52. His conclusions regarding the latter differ significantly from those of Nordenskiöld, and the arguments presented are of considerable interest in indicating the general line of attack which must be followed in order to arrive at the final goal—the authoritative dating of all Scheele's manuscripts. This pleasant duty will undoubtedly attract the keenest collaboration of chemical historians in all countries in the more tranquil future.

JAMES KENDALL.

# PHOTOGRAPHIC IDENTIFICATION OF TIMBERS

## Studies of the Identification of Timbers

With a Note on the Seasoning of Wood. By Alexander L. Howard. Pp. v+110. (London : Macmillan and Co., Ltd., 1942.) 36*s*. net.

MR. ALEXANDER L. HOWARD'S well-known and much-used book entitled "A Manual of the Timbers of the World", of which the last edition was published in 1934, contains no illustrations of the structure of wood. In order to remedy this defect, and to facilitate the identification of timbers, he has now published a new companion volume, of which the principal contents consist of 504 photographs of transverse sections of different kinds of wood magnified by ten. Each illustration is about 3 cm. × 5·5 cm. and therefore represents an actual cross-sectional area of just over 1½ sq. cm. of wood. All these illustrations were prepared by Mr. G. R. Keen from microtome sections which he himself cut from Mr. Howard's own collection of authentic specimens. The work entailed must have been very considerable, and to have produced a book of this kind after three years of war shows no small enterprise on the part of all concerned.

One must confess, however, that the result is somewhat disappointing. In the first place the illustrations are of very variable quality ; while some of them are reasonably satisfactory, others fail to give a fair representation of the timber concerned. This applies especially to Nos. 42, 57, 67, 113, 121, 136, 278, 359, and 370, to mention a few of the less inspiring. Illustrations more like those in H. P. Brown's "Atlas of Commercial Timbers of the United States" or Pearson and Brown's "Commercial Timbers of India" would have been far more useful. As, moreover, timber merchants generally have to examine a transverse surface of a solid piece of wood cut with a sharp knife, rather than sections, it would have been far better to photograph the actual surface of the wood. Only a highly skilled photographer could secure the best possible results by this method, but the work entailed would have been well worth while. It is a great pity that Mr. Howard went to the trouble of preparing a special set of sections when comprehensive collections of microscopical slides already exist at several institutions where the identification of timbers and the preparation of photomicrographs are matters of routine. By collaborating with one or more of these institutions a better result could have been achieved.

It is, besides, impossible to portray all the possible variations in wood structure which occur within a single botanical species in a solitary photograph of a cross-sectional area of just over 1½ sq. cm. This is one of the reasons why the book does not always enable the user to identify the woods with certainty. If verbal descriptions as well as the illustrations had been included, some idea of the variations which are to be expected in a single kind of wood could have been given. Another difficulty is that many timbers, especially among the softwoods, can be identified with certainty only by characters visible with a compound microscope. By relying on lens characters alone and comparing them with the illustrations in this book, it would, for example, be quite easy to confuse the timbers shown in Figs. 241, 314 and 453 respectively. The botanist

and forester will also object to the curious alphabetical sequence in which the timbers are arranged; vernacular, trade and botanical names having been used quite indiscriminately. The separate indexes of botanical and other names at the end of the book help to overcome this defect. In many instances the botanical names are not recorded at all, which is to be deplored in a work of reference. This curious arrangement is similar to that previously adopted in "A Manual of the Timbers of the World".

It is rather surprising in a book on timber identification to find that the only text, apart from the preface, consists of some forty pages describing the conversion and seasoning of timber. This, however, provides a useful and authoritative summary.

Taken as a whole, the book will be found helpful in identifying timbers, especially by those who are casually interested or to whom a collection of authentic specimens is not easily accessible. It also enables a rapid preliminary comparison to be made whenever a specimen is received for identification. It will, however, be desirable to consult other sources of information when precise and accurate identifications are required; for example, when settling legal disputes.

If Mr. Howard had taken some of his many scientific friends more fully into his confidence before publishing this book, a notable addition to our applied botanical literature might have been achieved. A book based on his long practical knowledge of the trade, combined with that of an experienced botanist or forester, would have been well worth while.

C. R. METCALFE.

---

# HYDROGEN IONS IN PURE AND INDUSTRIAL CHEMISTRY

## Hydrogen Ions

Their Determination and Importance in Pure and Industrial Chemistry. By Prof. Hubert T. S. Britton. (Monographs on Applied Chemistry, Vol. 3.) Third edition, thoroughly revised and enlarged. Vol. 1. Pp. xix+420. 36*s*. net. Vol. 2. Pp. xix+443. 36*s*. net. (London: Chapman and Hall, Ltd., 1942.)

THE appearance of a third edition of Prof. Britton's well-known text-book on "Hydrogen Ions" will be welcomed by those physical chemists who are concerned with the control of analytical and industrial processes by means of *p*H measurements. The ten years which have elapsed since the publication of the second edition have seen a large increase in the original literature of the subject and this has necessitated a considerable increase (some 274 pages) in the size of the book and its division into two volumes. The book is well printed on good paper and shows few signs of war-time austerity, with the exception of the price, which has increased nearly 200 per cent: perhaps this is only the shape of things to come.

The importance of *p*H measurements in analytical operations, electro-deposition and tanning processes, in the sugar, paper, brewing, dairy and explosive industries, in baking, water purification and sewage disposal, in agriculture and the textile and dyeing industries, in ore flotation, etc., fully justifies the appearance of this new edition, for it is a valuable contribution to our technical sinews of war. The book is a mine of information particularly concerning the practical aspects of *p*H measurement, and the author draws freely on his extensive practical experience in his critical assessment of the experimental methods described. The numerous tables of information and practical notes make the book a valuable *vade mecum* for all concerned with *p*H measurement.

Besides the more technical aspects of hydrogen ion measurements, the author discusses subjects of more academic interest; for example, the ionization of dibasic and poly-basic acids, the Lowry–Brønsted theory of acids and bases, etc. The new edition also includes a chapter on oxidation-reduction processes, including the use of redox indicators.

The book has been written primarily for those concerned with the industrial aspects of physical chemistry. Those concerned with the more theoretical aspects of the electrochemistry of solutions will find in the book much to interest and instruct them, but some will perhaps be a little dissatisfied with the treatment of the more modern aspects of the subject. At what stage in his course should a student be introduced to the newer theories of electrolytic dissociation? This question, no doubt, exercises the minds of many teachers. Prof. Britton has adopted in his book, what is the common practice, of first tentatively applying the Arrhenius theory to strong electrolytes and only at a much later stage, half-way through the first volume, introducing the activity concept. This procedure is not altogether satisfactory as it necessitates frequent qualification of statements in the earlier part of the book, a procedure which must cause confusion to a reader not already familiar with the subject.

So much has already been written of *p*H and buffer solutions which is based on the erroneous assumption of Arrhenius concerning the dissociation of strong electrolytes that considerable confusion would be caused by changing to the more satisfactory thermodynamic basis. The standard of reference of any potentiometric scale is an arbitrary one, so why change it, even if the older definition of the standard hydrogen electrode is not satisfactory? The author gives these reasons (pp. 292–294) for his retention of the original definition of *p*H, and many would agree on grounds of expediency. The criticism of the modern theory given as an additional reason for retention of the older concepts will not meet with such wide agreement, for the statement concerning the impossibility of determining single ion activity coefficients is perhaps a little unfair; a very similar criticism can be made against the concept of the single electrode potential used by the author.

The chapter on the Debye-Hückel theory has been largely re-written, but room has not been found to include an account of the success which has attended the application and extension of these ideas to the interpretation of the electrical conductivity of strong electrolytes and the effect of high potentials and high frequencies on the conductivity. No mention is made of the interesting work of Wien and of Onsager on the effect of high potentials on the dissociation of weak acids, nor is the heavy hydrogen ion discussed. Reasons of space, no doubt, made it necessary for the author to circumscribe his field.

Another edition of this book will certainly be called for in the not too distant future, and it will no doubt be necessary for Prof. Britton to put the chemical community more in his debt by enlarging his book still further.

H. L. RILEY.

# DARWIN MANUSCRIPTS AND LETTERS

## GIFTS TO CAMBRIDGE AND TO DOWN HOUSE

A GENEROUS and timely grant from the Pilgrim Trust has enabled the owners of certain important manuscripts of Charles Darwin to present them, some to the University Library at Cambridge and some to the British Association for preservation at Down House. The gift includes the manuscript of Charles Darwin's autobiography, the manuscript of the diary of the *Beagle*, with the field note-books from which it was compiled, most of the manuscript of the "Origin of Species", the manuscript of "Movement in Plants", "Climbing Plants", and other works; correspondence with Wallace, Samuel Butler, Huxley and other contemporaries; a number of personal papers and of memoranda relating to Down; and a collection of pamphlets, some with his annotations. It was in 1842 that Charles Darwin went to live at Down House. The first sketch, in his handwriting, of his species theory, written in 1842, is included in the gift.

A wise division of these manuscripts has been made. To the Library at Cambridge go the papers which, as will be seen, possess the highest possible value to the history of scientific research—papers which generations of future students may well wish to reinvestigate. To Down House, Darwin's home from 1842 until his death in 1882, now held by the British Association as a national memorial under the gift of Sir Buckston Browne, there return those priceless relics which will be most appropriate for those who visit the place to see—"exhibitable objects", as they were termed by one of those responsible for the division. Down House is closed to the public now, but when it becomes possible to reopen it, the collection of Darwiniana, viewed before the War by some seven thousand visitors annually, will be found to be enhanced by additions of unique personal interest.

A few examples only can be chosen for mention here out of the large mass of material comprised in the gifts. Among the documents destined for Cambridge are, foremost, sketches of "The Origin of Species", dating from 1842 and 1844, and manuscripts of chapters of the work as originally planned, and before the work was abstracted for publication in 1859. There is a fair copy of a draft, annotated by Darwin and Hooker, on "Varieties in Large Genera". There are manuscripts, complete or partial, of, or relating to, the "Expression of the Emotions", "The Movements and Habits of Climbing Plants", the "Cross- and Self-fertilization of Plants", "The Power of Movement in Plants", and other works. There are also manuscripts of a number of short papers communicated to scientific societies and periodicals.

Numerous scientific notes, in books or on loose sheets, are included in the collection. Some are very early, dating from Darwin's short period at the University of Edinburgh as well as from his Cambridge days. Among the material of later date is much that relates not only to the major works but also to other investigations—the names of the parallel roads of Glenroy and of Salisbury Craigs appear; glacial studies, coral reefs, Peloria, phyllotaxy, pangenesis, embryology, hybridism, are a few among many subjects. Memoranda for later editions of "The Origin of Species", "The Descent of Man", "Coral Reefs", "Climbing Plants", "Orchids", "Cross- and Self-fertilization" are included.

In this group of documents there are also the small brass-clasped notebooks kept during the voyage of the *Beagle* and the classified scientific notes made up from these: it is to be noticed that as each page in the notebooks was collated it was crossed through. The very records of observations and incidents made during that arduous voyage, often, it must have been, in circumstances of difficulty and stress, cannot be viewed without reverence; and they will be available to the view of those who visit Down in future, for they go back there, together with the manuscript of the "Diary", which, as is well known, was published verbatim not many years ago under the care of Lady Barlow. The classified scientific notes, however, are rightly included in the Cambridge collection.

Letters are many. These have, of course, been exhaustively worked upon during the compilation of the "Life and Letters of Charles Darwin" and of "More Letters of Charles Darwin"; nevertheless, they again are more appropriate to a library than to exhibition, and the majority go to Cambridge, though those written from the *Beagle* are retained for Down House with the notebooks. It has been noticed that such few letters as in normal times are open to view (in stands) in the Down House collection are assiduously read by many visitors; but correspondence could never be exhibited in bulk.

There are a few scientific notes relating to Down and its neighbourhood, and these now return to their source. There is, for example, a list of plants, grasses, etc., on the lawn at Down, in 1856–58: it might be a labour of love for a botanist to determine which of these, and how many more, appear there now. Among other local observations, there are the notes which were kept by Horace Darwin, from 1878 onward, in continuation of his father's study of the work of earthworms. Rainfall records are associated with the dampness and dryness of the soil, and these with measurements of the movement of the heavy stone (still in its place) which has become known as the wormstone: the term 'wormograph', which heads the notes, was mercifully relinquished.

Apart from the material already mentioned, the bulk of the gift to the British Association is not of a scientific character, but intimate and personal to Darwin, as befits a gift to the present guardians of his home. His own diary of his health, from 1849 to 1854, survives. A number of private account-books have been preserved. It is on record that Darwin rated his own business ability highly (if that phrase be not inapplicable to a man so innately modest); the account-books bear out this estimate. Personal expenditure is meticulously classified under various general headings—his partiality for snuff, by the way, is exhibited under the heading of "Amusements", and that of Mrs. Darwin for the theatre is apparent before they left London to live at Down. No less apparent is their generosity to dependants and others. Much may be inferred from these accounts concerning the regime at Down: the items of expenditure on the estate are not without value for the guidance of those who now are charged with its maintenance; and the entries, in earlier days, concerning livestock and so forth do something to justify the surprising reference which occurs in Bagshaw's Directory of 1847—"Darwin, Charles, farmer".

# EFFECTS OF CLOTHING AND FUEL SHORTAGE ON HEALTH*

By SIR Leonard Hill, F.R.S.

HAIR, feathers, fur and clothes protect the body from loss of heat, not by the quality of solid substance but by the air entangled in the meshes of these. Air is a bad heat conductor; warmed up to skin temperature and kept stationary, it acts as an insulator, preventing heat loss.

If the thermal conductivity of air be taken as unity that of wool fibre is 6, of water at least 240. The heat capacity of water is more than 3,000 times that of air, hence the great cooling power of cold water. A given volume of fur consists of about 2 per cent solid and 98 per cent air. A rabbit with skin shaved and varnished had its heat loss increased by nearly 1¼ times in a room at ordinary temperature.

Darwin described natives of Tierra del Fuego—the woman with babe at her breast, naked in the falling sleet, the man with an otter-skin the size of a handkerchief, which he shifted to the side struck by the wind. Sleeping on the ground like hares these natives had to commit infanticide, so hardy were they, to keep the population down to the food supply. Native Australians kept dogs to warm themselves at night, stripping bark off a tree to protect their naked bodies from wind. Eskimo dressed in furs withstand howling blizzards and temperatures as low as 70° F. of frost, and will crouch with their spears over the holes patiently waiting for seals to come up to breathe, and so stay even for three days. In their igloos, built of snow blocks over ice, which is much warmer than frozen land, they use blubber-lamps, and are so warm with these and their own body heat, that they discard all clothing while inside. Roman Catholic priests, born in Paris, have acclimatized themselves to live as Eskimos protected by fur garments. One such priest lived in a hole in the ground, far colder than an igloo. The northern Chinese, who endure five months of rigorously cold weather, use little fuel, but attain comparative comfort by wearing a wadded gown with long sleeves, and wadded trousers bound round the ankle. Cotton waste is used as wadding. Contrast these garments with the thin underclothing, short skirts, silk stockings and thin shoes of our womenfolk. Here is the way to save fuel—if people wear suitable clothing, houses and factories need be far less heated. The Chinese do not have an open fireplace with most of the heat going up the chimney, but a stove, with a long metal pipe as flue, which, while traversing the room, gives up its heat.

To save fuel women's thin and flimsy garments can be amplified by overalls, trousers and tunics, with such undergarments as are available. Shawls, overcoats and mackintoshes can be worn indoors for sedentary occupations, and their protective effect can be amplified, if needed, by a hot bottle to the feet and a rug over the knees. People can thus keep warm without artificial heat, as they do in the back seat of a motor-car. The factories would then have to be artificially heated only just enough to keep the hands warm for skilled work.

For sedentary occupations an ordinary citizen secures an atmosphere under his clothes of about 91° F.; only about one fifth of his skin surface is exposed to the air. Naked he finds a room at 80° F. pleasant, one at 60° F. cold. Those who habitually go with little clothing and are most exposed to the open air show the greatest immunity to what are termed 'colds'—respiratory affections which are really caused by infection in stuffy, artificially heated rooms. Leaving aside the question of fuel-saving, modern girls in their scant attire get the advantage of sun and air, as does the boy scout with shorts, bare knees and a shirt open at the neck. Babies, for fear of cold, are often overclad, and head sweating and evaporation from the lungs are then sometimes the only means left for getting rid of body heat. The children in an open-air sanatorium, clad in one garment, sit up in bed and play, indifferent to open windows. Out of doors they enjoy exposure nude to sun and air, but the exposure must not be overdone. The children must be able to assimilate enough well-chosen food to produce the body heat production required.

Exposure to cold makes the lamp of life burn brightly. A baby is born with great powers to withstand changes of climatic environment. Well fed, and given some exposure to open air and sun, naked when the weather is good, allowed plenty of kicking and crawling, with no prolonged confinement when awake in cradle and perambulator, with long sleeps out of doors, and light clothing, babies grow up virile with strong muscles and firm bones. While in winter a man may carry a tenth of his weight in his clothes, a dog carries only 2 per cent of its weight in its fur. A woman in modern dress carries less than half as much as a man, but have in consequence suffered no more from 'colds', pneumonia or rheumatism, and their death-rate has not been put up. The secondary schools have turned out fine, healthy and athletic girls and the women have worked wonders in the munitions factories.

Clothing should not be so heavy as to interfere with the taking of vigorous exercise. The athlete wears scanty clothing because his efforts may increase his heat production by five times or more.

It is a mistake except in very cold weather to put on an overcoat when going out to walk. The overcoat is useful when sitting indoors so as to allow a window open on a cool day. It is only the old, the underfed and ill and feeble who require very warm clothing. It should be kept in mind that those who are paralysed, anæsthetized or in a state of shock have lost their power of heat regulation and may easily be over-heated by hot bottles and too much clothing. The difference between the winter and summer pelts of the horse and cow show the small amount of extra clothing needed to face the open air in winter. Thick woollens and furs are needed not by citizens but by arctic travellers, airmen and soldiers in freezing trenches.

Clothes require to be made so as to be easily adjusted to changes of climate, in place of being fashioned to satisfy vanity. They should be as light as possible, allow free evaporation, become to the least degree wet with sweat and not cling to the skin when wet. The cellular structure produced by weaving, whether of wool, cotton, linen or silk, secures conditions which by entanglement of air gives warmth, pliability and evaporative power. Smooth, closely woven and glazed materials, as in a mackintosh or oilskin, give protection from wind and water. Wool has an elastic fibre which when worn keeps the garment off the skin, and prevents it clinging when wet. A fine woven linen or cotton is cooler than flannel because less air is entangled within the meshes. Made equally cellular in structure, linen or cotton

* Substance of a Chadwick Public Lecture delivered on October 6.

garments are as warm as flannel, but they cling when wet.

The question of wetting and clinging and of wearing and washing properties have to be taken into account. By taking off an outer garment, and by free ventilation, work can be carried out in factories in warm weather and without excessive call on the workers' sweat mechanism, which is the emergency method of keeping cool.

Fashion and custom should not prevent people taking off outer garments when feeling too warm. Employees should then be encouraged to work in their shirt sleeves, or bare to the waist. Heat loss from the body is then made easier by ventilation and free evaporation of sweat and by radiation of the skin to cooler surroundings. The evolution of the warm-blooded animal took place when animals warmed up by the sun succeeded by greater activity so induced, and came to evolve mechanisms for lessening heat loss in the shade by increasing heat production. Tropical lizards expand their pigment cells in their skin, and, absorbing sun rays, are warmed up to about 100° F. and then become very active. By open mouth and rapid breathing they evaporate enough water to prevent over-heating. At night they become cold and inert. Such lizards warmed by hot water pipes at the Zoo died in the winter. Given radiant heat on my suggestion, they eat and thrive. At body temperature black skin emits radiant heat rays just as much as white skin, but white skin reflects sun rays about double as much as black, which also absorbs much more. In the black and white furred animals exposed to the sun the black patches are much warmer than the white; so too, in the sun the dark hair of the scalp is much warmer than the white skin, but custom prevents consciousness of this difference. The sun's rays absorbed by the pigment of the skin increase transpiration from the capillaries and excite sweating and so cooling by evaporation. The black skin of a Negro when glistening with sweat reflects sun rays. Owing to protective pigment his skin can be thin and the blood vessels near to the surface; so the Negro loses heat easily from shaded parts of his body. The horny layer of the skin absorbs the short, active ultra-violet rays, and its thickening through exposure to these protects from sunburn. The pigment produced in the white skin by exposure to the sun protects the deeper parts of the skin from over-heating.

Convention keeps children clothed in the tropics when they should wear only a loin-cloth, tan in the sun, be in and out of water and live open-air lives. Indoor conditions in the tropics make white women fade and age quickly. The white man can acclimatize himself to work in tropical heat when not over-clothed and overfed. The conditions which favour heat-stroke are tight clothing and hot ground, high air humidity, little wind and crowding. The limits of heat regulation in still air are wet bulb temperatures of 90° F. and 93° F. in air moving at two miles an hour; but work is then very inefficient. It is then most important to secure proper cooling of the body for workers by suitable clothing and ventilation. The heat loss from the body of a man engaged in ordinary physical work is required to be about three times that at rest, to counteract the greater body heat production.

The absorption of heat from the sun or a furnace may be much greater than the ordinary rate of heat loss, particularly in the case of a man in a black or dark garment. The conditions liable to give heat-stroke are given by soldiers marching in full uniform, in close column in the sun on a calm day. Open order, stripping off of clothes, adequate water to drink, frequent rest, and a light diet are the means of prevention. White garments and helmets, and tents, reflect most sunlight, and the garments need to be open and flapping, so that ventilation is free. Shorts open at the knees, shirts open and short in the arms, and low cut and open in the neck are needed for hot climates. Aluminium foil can be used as a lining for tents to reflect sun-rays. Black or dark garments are worn in cold climates to absorb heat rays.

The cooling power of wind is enormous when the temperature is low. To resist this flying or arctic clothing consists of an outer layer of windproof material—strong, light, waterproof cloth will do—with inner layers of soft, fluffy woollens, entangling plenty of air. The garments join and even overlap, so that no wind enters at the neck, wrist, waist or ankle: a tunic with hood in one piece, gloves pulling up well over cuffs, and confined by straps, trousers coming well over tunic and confined by a belt, long boots made of supple hide coming well over trouser legs and strapped there, with soft woollen socks inside. A great trouble to arctic travellers is the moisture taken up by their sleeping-bags, which freezes by day and has to be thawed by night. Boots are best taken into the sleeping-bag to prevent them freezing. Wolverine is the fur used by Eskimos for head-cover because it does not take up the moisture breathed out.

Misty, damp atmosphere feels chilly owing to the hygroscopic properties of clothes and consequent dampness, with increased loss of body heat by evaporation of this moisture, while there is absence of radiant heat. Radiant heat from the sun and bright sky and warm ground or wall, make a great difference to comfort.

When bone dry, flannel will take up about 40 per cent of its weight of water, dry cotton or silk about half as much as wool; the physical process of the absorption of water by dry materials raises their temperature. For example, three layers of wool wrapped round the bulb of a thermometer were made quite dry in a drying-chamber. The thermometer rose 10° F. above the room temperature when it was suspended in the room owing to moisture absorbed from the air. Hence the warm feeling when well-dried clothes are put on. A woven cellular material takes up a great deal of water when wet, thus the clothing of a soldier may take up 8–9 lb. of water. To evaporate this amount would take up all the day's heat production of a sedentary worker. Woollens, owing to their elastic fibres, stick least to the skin when wet, and air still entangled in the meshes gives some protection against heat loss. Flannel is made up of 90 per cent air by volume and 2 per cent solid; smooth materials contain about 50 per cent of air. Starching and glazing make a garment almost airless, but impermeable to wind. Thus the smooth lining of an overcoat halves its permeability by wind.

While tropical clothing has a thickness of about 2 mm., winter clothing may be 12 mm. thick. The heat-retaining efficiency of clothing materials can be evaluated by means of the katathermometer. This, like the skin, is very sensitive to the cooling effect of wind. The ordinary thermometer gives the average temperature of the surroundings and is not affected by air movement. A room is comfortable when the 'kata' cooling power is 5–6. With the 'kata' clothed

in a thick woollen glove the cooling power is about half what it is with the naked 'kata'. Where the so-clothed 'kata' gave readings of 3–5 and the naked 'kata' 6–10 on sunny days one can sit out in comfort in ordinary clothes. When in very cold weather the clothed 'kata' gave a cooling power of about 20, and the naked 'kata' about double as much, two overcoats, thick gloves and a muffler were needed, and even then one had to shelter from the wind to keep warm. If a rubber glove is pulled tight over the bulb of the 'kata' it gives almost no protection, but put on loose with fluffy wool underneath the protection is very great. When gloves of knitted wool, cotton, etc., are compared on the 'kata' it is evident that the nature of the fibres makes little difference. It is the air stationary in the meshes which protects. Three knitted garments put on the 'kata' bring down the cooling power to about one third of that of the naked 'kata'. If the outermost garment be wet the protection is lessened only a little, as the cooling by evaporation from this coat is small. If a single, wet, thin, knitted glove clings to the 'kata' the rate of cooling is very greatly increased owing to evaporation. The 'kata' then becomes a measure of cooling power by convection, radiation and evaporation.

The cooling power of a wet 'kata' placed between the shirt and the skin is about trebled when a table fan is directed to blow on the body. The effect of such a fan in cooling the skin by convection and evaporation of sweat is thus made evident. The 'kata' does not actually give the cooling power exerted on the body, because it is a small bulb with a big surface in proportion to the bulk and surface of the large human body. The 'kata' cooling powers for comfort are then determined empirically. The cooling power exerted by water on the 'kata' is fourteen times that of air at the same temperature. Stirring the water makes the rate of cooling much greater. If a thick woollen glove be loosely put on and covered with a thin rubber glove, and this tied on to the stem so that no water can enter, the two coats protect the 'kata' from cooling in cold water very greatly, for example, they make it one seventh of that of the naked 'kata'. The protection becomes much less when the inner woollen glove is wet, but is still considerable. The clothes are then a protection against heat loss when one is immersed in water owing to the air entangled in the meshes, and the retention of water therein which becomes warmed by the body.

Swimming naked in the cold sea puts up the heat production of an ordinary man seven or eight times. Channel swimmers are protected by a thick layer of subcutaneous fat, which acts as an insulator, and their skin is well greased so that water cannot soak into it and increase its conductivity. Their heat production is very great owing to the powerful exercise as well as the cooling effect of water. They use up, therefore, some pounds of body fat and make this up afterwards. The heat loss of a naked man in air of 46° F. and a wind of 6½ ft. a second was found to be twice as great as when clothed. Exposed in boats or on rafts people want warm clothing and water or windproof outer garments to keep themselves from dying of cold. Such garments and enough water to drink are the two main essentials, as people when kept warm can live many days without food.

Dr. Argyll Campbell and I made observations on the rate of heat loss from the body of a subject exposed to wind and splashing of waves, either naked or in light clothing, or in such clothing plus a one-piece waterproof suit. This was made by Sir Robert Davis, of Messrs. Siebe Gorman, Ltd. The protection afforded by this suit was great, reducing the heat loss by one half. I directed the attention of the Minister of Transport to these observations, with the result that the Ministry designed a two-piece suit with a hood, all made of thin, light, oilskin material. The dress packs up in the hood, and this is carried by the merchant seamen just as a gas-mask is carried. More than 200,000 of these dresses have been issued, and the use of these contributes to the saving of life. The suit is coloured bright yellow, a colour easily seen from an aeroplane.

## NATIONAL FLOUR AND BREAD

### SECOND REPORT

From the Scientific Adviser's Division, Ministry of Food

SAMPLES of National flour and bread are being examined as a routine. The first report[1] covering 303 samples, of which 300 were received before 85 per cent flour became compulsory (March 23, 1942), showed that the mean values of fibre and $B_1$ were 0·70 per cent and 1·05 I.U./gm. respectively. The present report is a summary of the results obtained on 322 samples milled since the compulsory date together with a comparison of the quality of the flour before and after that date; it also summarizes the quality of 459 samples of bread.

*Fibre and* $B_1$. Table 1 shows the different levels of fibre and $B_1$ over the whole 322 samples:

TABLE 1

| Fibre | | Vitamin $B_1$ | |
|---|---|---|---|
| Value % | % of samples | Value % | % of samples |
| ≤ 0·4 | 8·7 | ≥ 1·10 | 46·6 |
| 0·5 | 13·7 | 1·00 | 80·7 |
| 0·6 | 29·8 | 0·90 | 93·5 |
| 0·7 | 50·6 | | |
| 0·8 | 70·8 | | |
| 0·9 | 85·1 | | |

Since 85 per cent flour was made compulsory in Great Britain, millers have on occasions been allowed to admix a small amount of Canadian G.R. flour. In the period under review the average dilution in the samples received was 8·7 per cent. This would not affect the $B_1$ value, since the added G.R. flour is fortified to nearly the same level as National flour, but it would tend to reduce the fibre content; at a figure in the region of 0·7 per cent this reduction would be slightly less than 0·05 per cent. To compensate for this *all* the experimentally determined values of fibre have been increased by 0·05, although this correction, as an overall figure, is too great.

*Riboflavin.* Six flours taken at random from those having a fibre content of 0·7 per cent were examined for riboflavin[2], with the results shown in the second column of Table 2.

TABLE 2

| Sample | Riboflavin γ/gm. | $B_1$ I.U./gm. | Germ content (approx.) |
|---|---|---|---|
| | | | % |
| 1 | 1·7 | 1·00 | 1·0 |
| 2 | 1·9 | 1·10 | 2·0 |
| 3 | 1·7 | 1·15 | 1·0 |
| 4 | 1·7 | 1·20 | 1·8 |
| 5 | 1·3 | 1·00 | 1·2 |
| 6 | 1·7 | 1·15 | 1·0 |
| Average | 1·7 | 1·10 | |

*Germ Content.* In the absence of any satisfactory chemical method for estimating germ, estimates have been made based on the microscopic appearance of the flours when compared with standard preparations. The final column in Table 2 shows the results obtained with the six flours: a thorough examination was also made of twenty other flours of varying fibre content and taken at random. The same general result was obtained, the range of germ content being 1–2 per cent, with an average of 1·5 per cent. It should, however, be remembered that it is not the quantity but the quality of the germ that matters, and recent work has indicated that the dry milling of National flour will tend to retain the scutellum or vitamin $B_1$-rich fraction of the germ[3].

*Granularity.* There is no official specification for this aspect of National flour, but the Medical Research Council has advised (June 2, 1942) that all coarse bran (particles greater than 0·5 mm. cross-section) should be excluded, while the remaining particles should not have a cross-section greater than 0·2 mm. In practice this means that all the flour should at least go through a No. 5 silk. To some extent the ideal of a low fibre content and fine particle size run counter to one another, since in obtaining the maximum amount of endosperm (and least fibre) it is essential not to chop up the bran too finely. Progress, however, is being made, and the following gives a comparison of the average values obtained from the same hundred mills on samples (*A*) before, and samples (*B*) after March 23, 1942. In the case of samples (*B*) correction was made for the added G.R. flour, which was assumed to pass through a No. 10 silk.

| | *A* | *B* |
|---|---|---|
| Over 32 g.g. (aperture 0·60 mm.) | 3·5% | 1·2% |
| Through 32 g.g. and over 5 silk | 7·7% | 6·4% |
| Total over 5 silk (aperture 0·27 mm.) | 11·2% | 7·6% |

The improvement is also evident from the following figures, which show the average percentage fractions, for each successive 100 samples received, over No. 5 flour silk and No. 8 silk (aperture 0·19 mm.) respectively:

| Sample No. | % over 5 silk | % over 8 silk |
|---|---|---|
| 1–100 | 11·9 | 15·0 |
| 101–200 | 10·5 | 14·9 |
| 201–300 | 9·3 | 14·2 |
| 301–400 | 8·4 | 13·0 |
| 401–500 | 5·5 | 9·9 |

*Comparison with Quality of Samples before March* 23, 1942. There are indications that the National average fibre figure is decreasing and that the range of variation is becoming narrower. In order to attempt a comparison those mills which sent in samples before (*A*) and after (*B*) March 23 have been included in a table in which each mill has been weighted on its milling capacity (sacks of flour per hour). In all, 149 mills have been included, and the following figures have been calculated for fibre:

| Limit of fibre | *A* % | *B* % |
|---|---|---|
| ⩽0·50 | 10·8 | 26·3 |
| 0·60 | 30·2 | 46·7 |
| 0·70 | 56·3 | 75·5 |
| 0·80 | 79·7 | 86·5 |
| 0·90 | 92·6 | 90·5 |
| 1·00 | 96·0 | 99·3 |

A number of millers, realizing that commercial bran as such contains a considerable amount of attached endosperm, have adjusted their milling methods so as to scrape off this endosperm without chopping up the bran in the process. In this way they have been able, after prolonged experiment, to produce an 85 per cent meal with a fibre of 0·35–0·40 per cent. This technique is being followed in other mills but a limit will be set by the need for extra machinery. The following are typical samples:

| | Sample 1 % | Sample 2 % |
|---|---|---|
| Over 5 silk | 0·0 | 0·4 |
| Over 8 silk | 1·5 | 2·2 |
| Over 10 silk | 9·3 | 5·8 |
| Fibre % | 0·4 | 0·35 |
| $B_1$ I.U. gm. | 1·00 | 1·15 |

## Quality of Bread

Four hundred and fifty-nine samples of bread have been examined. In every case a sample of the wheatmeal used was available in order to make any necessary check. The loaves were judged for quality by Dr. P. Halton and Mr. W. E. Spencer, and the following points taken into consideration: (1) general outside appearance; (2) volume; (3) crumb quality; (4) colour. Particular stress was laid on crumb quality, the standard being that of a first-quality commercial loaf. Four classes of quality were recognized—good, fair–good, fair and poor—and the following figures obtained:

| | | | |
|---|---|---|---|
| Good | = 278 | loaves | = 60·6% |
| Fair–good | = 102 | ,, | = 22·2% |
| Fair | = 58 | ,, | = 12·6% |
| Poor | = 21 | ,, | = 4·6% |

The chief defect was lack of proper fermentation and/or insufficient baking, giving a weak crumb.

The experimental work in this survey was carried out in the Laboratories of the Research Association of British Flour-Millers, St. Albans.

[1] Research Association of British Flour-Millers, NATURE, **149**, 460 (1942).
[2] E. C. Barton-Wright, NATURE, **149**, 696 (1942).
[3] J. J. C. Hinton, *J. Soc. Chem. Ind.*, **61**, 143 (1942).

# MINERAL RESOURCES OF THE U.S.S.R.*

By DR. DAVID WILLIAMS

SINCE the inception of the first Five-Year Plan in 1927 the U.S.S.R. has made great strides towards the goal of domestic self-sufficiency in mineral supplies. Under the ægis of central authorities such as the Institute of Geology and Prospecting and the Academy of Science, thousands of geologists have been engaged in the search for new resources, playing an essential part in the industrial revolution which has swept through the Soviet Union. Although vast areas still remain to be explored, probably no country is more nearly self-supporting, and certainly none has brighter prospects of industrial and agricultural expansion in times of world peace. To some extent this favourable position is due to methods of national economy, whereby commercial considerations are subjugated to national expediency.

* Paper read on July 25 at the Conference on Mineral Resources and the Atlantic Charter, arranged by the Division for the Social and International Relations of Science of the British Association.

The most important deposits of metallic minerals lie within the ancient and deeply eroded mountain chain which extends along the Urals and then swings eastwards through Kazakhstan into Central Asia, and to a lesser extent among the younger and more rugged mountains of the Caucasus and Eastern Siberia. In the gently undulating country of the Russian platform, to the west of the Urals, enormous deposits of potassium salts and phosphate rock ensure the Union a foremost rank in the production of mineral fertilizers.

Russia's immense reserves of coal, iron and petroleum afford a sure basis for industrial progress, and in each of these three most important commodities she is capable of long maintaining a surplus output.

## Iron and Ferro-Alloys

Even omitting the astronomical tonnages of comparatively low-grade quartzitic iron ores of the Kursk district, the Soviet reserves of iron ore have recently been estimated at more than 10,000 million tons, surpassing those of the United States. In 1940 Russia produced 28 million tons of ore, about two thirds of which was raised from the Ukraine deposits of Krivoy Rog and the remainder largely from Magnitogorsk and elsewhere in the Urals. Among other extensive deposits are the oolitic, brown iron ores of the Kerch Peninsula in the Crimea, the magnetites of the Kuznetsk region, and the hæmatites of Far Eastern Siberia. With such huge resources of iron ore it is clear that the Soviet Union has the opportunity not only of fulfilling her own internal demands, but also of contributing a generous export supply.

Among the ferro-alloys Russia has been, within recent years, the world's largest producer of manganese and chromite, supplying respectively about a half and a quarter of the total world output. In 1936 manganese resources were computed at more than 700 million tons, sufficient for more than 200 years output at recent levels, the chief ore bodies being the two famous deposits of Nikopol in the Ukraine, and Chiaturi in the Caucasus. Although the output of chromite has increased during the past decade, it has latterly been used almost wholly for domestic requirements of ferrochromium and chromium chemicals. The principal mines lie near Sverdlovsk in the Central Urals. Unless fresh discoveries are made, Russia may feel compelled to retain her entire production of chromite for home consumption.

Russian supplies of nickel have so far proved to be inadequate, but by exploiting several extensive low-grade nickel silicate deposits in the Urals and nickel sulphide bodies in the Kola Peninsula and in Northern Siberia, she may well become independent of imports in times of peace. According to present information, however, it is unlikely that the U.S.S.R. will ever raise a surplus supply of nickel.

For tungsten and molybdenum the Union relies very largely upon imports. Both metals occur in widely separated localities throughout European and Asiatic Russia, many promising discoveries having been reported. Workable deposits of tungsten ore (wolfram) have been located in the Transbaikal area, but no great reserves are claimed. Much is expected from the new tungsten-molybdenum concentrator at Tyrny-Aus in the heart of the Caucasus, and from other mills erected for the recovery of molybdenum in Kazakhstan and Eastern Siberia. It seems reasonable to infer that the U.S.S.R. will eventually become self-sufficient in molybdenum, though the outlook for tungsten appears to be less promising.

## Non-Ferrous Metals

Russia has for long held either first or second place among the world's platinum producers, and although full statistics have not been available lately, it is obvious that she will continue to be a foremost exporter of the metal. Until a few years ago, mercury was mined only at Nikitovka in the Donetz basin, but quicksilver deposits have now been opened up in the Kirghiz, and apparently the Union's mercury supplies and demands are roughly balanced.

Aluminium was first produced by the Soviets on an industrial scale in 1932, and although production failed to reach the projected output the amount of metal won from bauxite had risen to 55,000 tons in 1940. The hope that a total production of 200,000 tons of aluminium would be attained in 1942 cannot materialize, for some of the chief hydro-electric plants (Dnieper, Volkhov near Leningrad, Kandalaksha in Karelia) are now in, or close to, enemy hands. In favourable circumstances, there are good prospects of achieving and even exceeding this figure, though the discernible output for some considerable time to come will be required for domestic use. Bauxite reserves, sufficient for several decades, are estimated at 45 million tons, the largest and richest deposits lying in the Urals to the north of Sverdlovsk. Immense quantities of nepheline and alunite are also available for the production of alumina and aluminium, and already plants have been erected for treating nepheline tailings from the apatite works at Kirovsk in the Kola Peninsula. The potential supply of nepheline, which contains about 33 per cent of alumina, must exceed 100 million tons.

Although Russia produced more than 100,000 tons of copper in 1938, she also had to import approximately two thirds as much. Most of the copper smelted hitherto has been won from Uralian deposits (notably Degtiarsk, near Sverdlovsk) but the greatest ore reserves are in Central Asia, at Kounrad and Djhezkazgan near Lake Balkhash, and at Almalyk in the Tashkent area. The estimated resources of copper (metal) have been placed at 16 million tons, and although this may be an optimistic figure, it is clear that when the mines and smelters are working to full capacity there will be no need for the Union to import any copper from abroad.

Production of lead and zinc has been steadily increasing during the past twenty years. Although the position with regard to lead is not yet satisfactory, the zinc output is probably ample for domestic needs. During the three years preceding the outbreak of war the imports of lead and zinc averaged approximately 30 and 2 per cent respectively of the country's total requirements of those metals. Russian reserves of lead and zinc have been calculated at 11 per cent and 19 per cent respectively of the world totals, the chief deposits and refineries being in the Caucasus (Sadon) and in the Altai Mountains of Kazakhstan (Ridder, Chimkent, Sokolny, and Belousovsk). In view of the likely future demands, there appears to be small likelihood of the Union producing a surplus of these two base metals.

Up to 1937, Russia was almost wholly dependent upon imports for both tin and antimony, receiving annually about 12,500 tons of the former and more than 2,000 tons of the latter. Apparently the most

promising of the tin-bearing areas so far prospected lies in Eastern Transbaikal, but the recorded tonnages of proved ore are not large. Reports suggest that tin smelters may soon be operating in Yakutia and Tetiukhe, in Eastern Siberia. Unless tin substitutes are developed, however, it is inferred that the U.S.S.R. must continue to rely partly on imports of the metal. Valuable deposits of antimony ore have been discovered at Kadam Djai in the Kirghiz and in Central Siberia, and it seems justifiable to expect that Russia will be able to meet her own moderate peace-time needs of antimony.

Statistics for gold production are a State secret, but it is certain that the Union has adequate resources of this precious and enigmatic metal.

### Non-Metallic Minerals

Russia's position with regard to many non-metallic minerals is stronger than that of any other country.

In recent years the U.S.S.R. has been the world's largest producer of crude magnesite. The Satka deposit, near Cheliabinsk in the Central Urals, alone yielded more than 800,000 tons of the mineral in 1937; including nearby deposits, the reserves are reputed to be about 250 million tons. Hitherto most of the output has been utilized for refractory purposes, but some magnesium metal is also manufactured from Satka ore. Although the production of metallic magnesium was less than 4 per cent of the world total in 1940, the potential output is enormous, for there are extensive supplies of raw materials from which the metal can be extracted, notably the rich carnallite ($KMgCl_3.6H_2O$) deposits of Solikamsk in the Western Urals, brine from various salt lakes, and the Satka magnesites.

Russian geologists claim that the prospected phosphate rock deposits of the U.S.S.R. now exceed 60 per cent of the world's resources. Near Kirovsk, in the Kola Peninsula, remarkable bodies of apatite, discovered in 1926, have recently been yielding more than 2 million tons of ore annually, with reserves for another millennium. The principal phosphorite deposits occur in European Russia, in the regions of Kirov (Phosphoritnaya) and Moscow (Egorjevsk), but an extensive and favourably situated field near Aktiubinsk in North-west Kazakhstan is being developed to supply agricultural fertilizers for western Soviet Asia.

No details of mica production have been issued since 1935, when the Union held second place in world rank. The muscovite pegmatites of the Mama-Vitim area in Eastern Siberia and the Chupa Fjord district of Karelia, and the phlogopite veins of Slyudyanka at the western end of Lake Baikal, are doubtless capable of providing adequate supplies for domestic consumption. For many years the Russian output and export of asbestos has only been exceeded by that of Canada. The yearly production of chrysotile asbestos from the well-known Bazhenov field, near Sverdlovsk, is roughly 100,000 tons, the total reserves amounting to more than 30 million tons. It is unquestionably one of the largest and most productive asbestos fields in the world.

The region of Solikamsk, on the western slopes of the Urals, has long been known for its brines and salt works, but it was only after deep boring commenced in 1925 that the remarkable deposits of potassium and magnesium salts (sylvinite and carnallite) and the enormous masses of rock salt were thoroughly investigated over an area of some 700 square miles. Production started in 1932 and within five years the annual output had risen to more than two million tons of crude salts, and large quantities were being exported. Solikamsk reserves are claimed to represent about 80 per cent of the world's resources, consisting of 15,000 million tons of potash salts, 18,000 million tons of magnesium salts, and scores of thousands of millions of tons of rock salt. Even the famous Stassfurt deposits of Germany are dwarfed.

In 1938 Russia was among the leading producers of pyrite, with a tonnage approaching one million, derived chiefly from the Uralian cupriferous bodies (especially Degtiarsk) and from various coal mines. Expeditions to the Kara Kum Desert and the Gourdak Range in Turkmen territory, east of the Caspian Sea, have discovered huge supplies of native sulphur, quite comparable with the great Sicilian deposits. These Turkmen occurrences are likely to be the main future supply of sulphur, except in areas where it is being recovered during the treatment of sulphide ores.

Adequate resources of other minerals, such as graphite, fluorite and gypsum, are known to exist within the Union.

The development of mineral resources in the U.S.S.R. during the past fifteen years has far surpassed anything formerly achieved in a like period of the world's history. Sceptics may doubt the validity of some of the Russian estimates of ore reserves, but it should be recalled that vast territories still await detailed investigation and that the actual resources might well prove to exceed those now claimed. Despite the present marked deficiency in a few metals, notably tin and tungsten, it is reasonable to suppose that the U.S.S.R. will eventually become almost entirely self-supporting and may be able to export large quantities of coal, iron, petroleum, manganese, platinum, magnesite, phosphates, asbestos, potash and sulphur. The U.S.S.R., with her immense natural resources and man-power, has much to offer in the cause of world progress and welfare, and not least a share in her abundant mineral wealth.

## OBITUARIES

### Prof. A. Ukhtomsky

THOSE physiologists from Great Britain who had the good fortune to attend the International Congress of Physiology at Leningrad and Moscow in 1935 will remember the picturesque figure of Prof. Ukhtomsky and his novel and philosophic approach to the problems of nervous physiology. As successor to Wedensky, he had done much to develop the ideas of his brilliant teacher. It is with great regret that we now learn of his recent death in a message from Prof. K. Kekcheev addressed to the Physiological Society, on which the following notes are based.

Alexey Ukhtomsky was born in 1875 and for twenty years held the chair of physiology in the University of Leningrad, to which he was appointed on the death of his teacher, the well-known Russian physiologist Wedensky.

Ukhtomsky is known for his numerous researches into the excitation inhibition of the central nervous system. In 1911 he established the principle of the 'dominant', according to which, given the presence of any excited point in the brain, other auxiliary excitations do not call forth the usual reflexes but serve to enhance the excitation of the given point.

One of the most clearly demonstrated examples of the dominant is the substantial enhancement of the embracing reflex in male frogs at a certain season of the year when any part of the skin is excited. Several of Ukhtomsky's researches were devoted to the time factor and 'system history' in phenomena occurring in nerve tissue during excitation inhibition.

In recent years, Ukhtomsky was interested in the physiology of labour, and his laboratory, under the direction of his collaborator Prof. M. Vinogradov, was one of the centres of this science in the U.S.S.R.

The work of Ukhtomsky and his school was published chiefly in the *Proceedings of the Physiological Institute of the University of Leningrad*, of which he was editor, and in *Educational Records of the University of Leningrad*.

## Prof. K. N. Moss, O.B.E.

PROF. KENNETH NEVILLE MOSS, professor of coal and metal mining in the University of Birmingham since 1922, died on October 20 at the early age of fifty-one. Prof. Moss was very active and successful in the direction of the Mining Department of the University, and was mainly responsible for the raising of £100,000 for developments in the Faculty of Science, of which for four years he was dean. A notable scheme which he carried through was the institution of a number of scholarships to attract public-school boys to the Mining Department.

Prof. Moss was educated at Queen Mary's School, Walsall, and the University of Birmingham. He had practical experience of mining in the Cannock Chase, South Yorkshire and North Staffordshire coalfields and was for a year organizer of mining education for Derbyshire. Among other positions which he had held, he was chairman of the Advisory Committee on Coal and Petroleum of the Mineral Resources Department of the Imperial Institute, president of the National Association of Colliery Managers, president of the South Staffordshire and Warwickshire Institute of Mining Engineers, and a member of council of the Institute of Mining Engineers.

During the War of 1914–18, Prof. Moss was captain and adjutant to the 59th Divisional R.E., was awarded the O.B.E. (Military Division) and twice mentioned in dispatches. The loss of his forceful personality will be severely felt by the University of Birmingham. He leaves a widow and four daughters.

G. A. SHAKESPEAR.

WE regret to announce the following deaths:

Prof. Alfred Baker, emeritus professor of mathematics in the University of Toronto, where he occupied the chair of mathematics from 1887 until 1919, who was president in 1915 of the Royal Society of Canada, on October 27, aged ninety-four.

Prof. J. N. Collie, F.R.S., emeritus professor of organic chemistry in the University of London, on November 1, aged eighty-three.

Prof. J. C. Schoute, emeritus professor of botany in the University of Groningen, president of the Sixth International Botanical Congress, aged sixty-five.

# NEWS and VIEWS

## Educational Biology

EMINENTLY sane, though occasionally somewhat diffuse, are Mr. Hugh Ramage's views on "Educational Biology" (*Sch. Sci. Rev.*, No. 91; June, 1942). Emphasizing the key position of biology in any adequate scheme of education, he takes the unequivocal stand that educational biology should centre upon a study of the human organism. There are many biologists who refuse to accept this view, but the author cuts a good deal of the ground away from the feet of potential opponents by his recognition of the importance of studying organisms valuable in the illustration of principles. Mr. Ramage also trails his coat on the controversial topic of sex education, but he speaks very good sense, here as elsewhere. Very salutary is his endeavour to check the swing of the pendulum away from a mere study of cadaver, before it reaches the position of the unco-ordinated study of 'function' isolated from the organism that functions. Salutary, too, is his insistence on the need for attention in school to problems of variability and ecology. It is rather difficult to be certain from this paper whether the author's outlook is that of a holist or a dialectical materialist, and indeed the teleological implications of the statement that organisms form a "purposive" entity (albeit with inverted commas) give ground for suspicion that perhaps Mr. Ramage takes up no consistent philosophical position. But he poses clearly here many problems of educational method which should receive the attention of all teachers.

## Engineering in Agriculture

IN his presidential address to the Institution of Civil Engineers delivered on November 3, Sir John Thornycroft pointed out that his work has been so closely connected with the Navy, and to a smaller extent with the Army, that he considered it inadvisable in present circumstances to talk about it, as has usually been done by presidents of the Institution. He has, however, taken a great personal interest in engineering in agriculture, and he devoted his address to that topic. From the earliest times the engineer has played a very important part in helping the agriculturist in irrigation, drainage, land reclamation, and in the provision of implements which enable men, with the aid of oxen and horses, to do so much more than was possible with the primitive hoe and mattock. The address dealt in detail with the problems of land drainage, soil erosion, and the application of steam and internal-combustion engines to tractors and farming machinery—ploughs, machines for sowing seed in drills and for planting root crops and potatoes, and harvesting machines. The importance of research was emphasized and mention was made of the establishment by the Government of the Agricultural Machinery Development Board and of an Institute of Research in Agricultural Engineering. A very large home-grown sugar industry has been built up in Great Britain in recent years, and the British Sugar Corporation has contracts with more than 52,000 farmers, who provide 400,000 acres of the crop; the whole of the domestic sugar ration

allowed in Great Britain at present is home-grown. The application of electric power was discussed and its extension urged, with a suggestion that town dwellers and industrialists should be charged an overriding percentage so that supply companies would be able to distribute current to every agricultural holding at the low prices available to town dwellers.

## Agriculture To-day and To-morrow

THE Royal Society of Arts has arranged a special series of ten lectures on "Agriculture Today and Tomorrow", beginning on November 11. In organizing these lectures, the Society is carrying on what was for nearly a century one of the most important branches of its activities. At the time of the Society's foundation—1754—the methods of agriculture were practically those of the Middle Ages. Until the inauguration of the Royal Agricultural Society in 1838, the Society's Committee of Agriculture under Arthur Young was the most important body in Great Britain concerned with the welfare of agriculture. Under its auspices many improvements were made in agricultural practices. The Society also opened to the public its "Repository of Inventions", which contained an excellent collection of models of agricultural implements, and in 1761 it held an exhibition of agricultural machines. Although the present lectures are intended mainly for those actively engaged in agriculture, it is emphasized that the series will be of interest to laymen. A syllabus of the series can be obtained from the Secretary, Royal Society of Arts, John Adam Street, Adelphi, London, W.C.2.

## Utilization of Rural Waste

FOLLOWING on the article by Mr. Bransby Williams on the manufacture of fertilizer from urban wastes (NATURE, Sept. 5, p. 299), it is interesting to note that an experiment in rural sanitation is being conducted by Dr. A. T. Westlake on his estate at Sandy Balls, near Fordingbridge. The estate is used as a holiday centre, and a large number of visitors, living in huts, caravans, and tents, pass through it in the course of the year, in addition to a resident population of about forty persons. The Poore method was at first tried, but later Dr. Westlake adopted the Indore composting system of Sir Albert Howard with good results. All the night soil and other refuse on the estate is composted in heaps. There is separation of solids and liquids. By the use of specially dried earth and leaf mould, the collection and handling of the material is rendered efficient, easy, and hygienic. In winter the method so far adopted has been the use of small composting pits. The matured compost is used to manure what was formerly barren ground, but which has now become a healthy and flourishing kitchen garden. Plant disease has been very largely eliminated. It is clear from the experiment that the methods used here might well be tried in other rural communities.

## Engineering Cadetships

THE Government announces the foundation of engineering cadetships, open to youths of sixteen to nineteen years of age, inclusive, and leading to technical commissions in the fighting services. The Government will pay the necessary educational fees and allow each cadet a maintenance grant. Youths of 16–19 are invited to apply if (*a*) they left school before October of this year; (*b*) are not employed in any branch of engineering; and (*c*) have obtained at least the school certificate with a credit in mathematics or general science or physics or an equivalent examination. The length and character of the training, which will be at a technical college, will be adjusted to age and educational qualifications, and may extend to two and a half years. Boys of sixteen will have preliminary instruction at a technical college or other appropriate institution. The training courses will cover the basic engineering science required in the associate membership examinations of the Institution of Mechanical Engineers or the Institution of Electrical Engineers. In the case of the Institution of Mechanical Engineers, cadets who successfully complete their course will be exempted from sections A and B of the associate membership examination. Youths of eighteen who have been called up may apply for cadetships, and boys born in 1924 and still at school may also be accepted. Applications will be received by local appointments offices of the Ministry of Labour and National Service or by the Appointments Department, Sardinia House, London, W.C.2.

## Russian-English Technical Glossaries

As a result of the appeal by Sir John Russell, chairman of the Anglo-Soviet Scientific Collaboration Committee, for Russian-English technical dictionaries, sixteen glossaries of Russian technical and scientific terms have been collected and placed in the Science Library, South Kensington, London, S.W.7, where they are available for consultation. Most of the glossaries, which cover a wide range of subjects—military and naval terms, metallurgy, medicine, botany, fuel technology and bacteriology of fish—have been compiled by individuals during the course of their work in a special field. Some are printed, others are typed or in duplicated form, while others are in manuscript or on cards. A list of these glossaries giving the name and address of the compiler or donor can be obtained from the Secretary of the Anglo-Soviet Scientific Collaboration Committee, British Council, 3 Hanover Street, W.1. A location list of Russian technical glossaries has also been compiled by the Anglo-Soviet Scientific Collaboration Committee. This list, which incorporates the glossaries collected for the Science Library, also indicates the libraries in which copies of the chief Russian scientific and technical dictionaries may be found. Copies of the location list may also be obtained upon application to the Secretary of the Anglo-Soviet Scientific Collaboration Committee.

## Map of Europe and Middle East

A MAP of Europe and the Middle East on a scale of 1 : 11 million has been published by the Royal Geographical Society on behalf of the British Council. The map is drawn on Murdoch's third conical projection and extends from Western Europe, the British Isles and Iceland east to Rangoon and south to Abyssinia. It will fit obliquely with two adjoining sheets, North America to Britain and the Far East, which are now published in outline only but are to be completed later. Land relief is shown by contours and layer colouring in tints of brown and hill shading in lavender grey corresponding to a light thrown from the top left-hand corner of the plate. Contours are at 50, 100, 200, 500, 1,000 and subsequent 1,000

metres, which is fully as many as the scale can bear in some areas. Principal railways are shown as red lines and selected roads as red dotted lines. Political boundaries as in 1938 are marked and there are also shown oil fields, pipe lines, ancient sites, deserts, marshes and glaciers. No submarine relief is shown: water is blue. Names of countries and principal rivers and towns are in black. An edition with names in Arabic is to be published. The present sheet (No. 1), flat or folded, costs 5*s*., or, flat, with the outline edition of No. 2 and No. 3, which are not sold separately, 8*s*.

## Sir Robert Kane

UNDER the auspices of the Chemical Society of University College, Cork, Mr. D. Ó. Raghallaigh has recently issued an interesting booklet of forty-three pages dealing with the life and work of Sir Robert Kane (1809–1890), a pioneer of chemistry and of industry in Ireland. Kane studied medicine at Trinity College, Dublin, and became professor of chemistry at the Irish Apothecaries' Hall at the age of twenty-two. After his appointment to the chair of natural philosophy at the Royal Dublin Society in 1834, he published his important work on ammoniacal compounds of mercury, copper and zinc. This was followed in 1840 by a research on the colouring matter of lichens, and soon afterwards Kane was elected F.R.S. His "Elements of Chemistry", completed in 1843, achieved fame as a standard text-book. He took far-sighted views of Irish industries and agriculture; for example, he directed attention to the chemical potentialities of Irish peat and potatoes, and depicted the Shannon Valley as the future industrial centre of Ireland. In organic chemistry he accomplished the first synthesis of a cyclic compound (mesitylene) from an open-chain one (acetone). In 1845 Kane became the first president of the new Queen's College, Cork, and in the following year he was knighted for his services to science and Irish industry. After his resignation of the presidency in 1873 he became first dean of the Royal College of Science for Ireland, and later he was appointed vice-chancellor of the Royal University. One of Kane's sons commanded H.M.S. *Calliope* in the historic escape of this ship from Samoa Harbour during the hurricane of March 15, 1889.

## Wood-Pigeon Investigation

THE third Bulletin of the Wood-pigeon Investigation, issued by the Edward Grey Institute of the University of Oxford, covers some of the findings of the past nesting season, and the expansion of the investigation to have 500 observers recording 250 birds a month next breeding season, thus recording more than a million birds. In some parts of Great Britain during 1942 the birds were very sparse with only one or two nests in a hundred acres, and in others their nests were sufficiently concentrated to show definite breeding colonies with preference for certain areas. The most densely populated haunts were young spruce plantations. At the peak of the breeding season in August (it is much later than with most birds) these dense haunts had as many as twenty nests in four acres. At the end of September there were still 10–20 nests occupied in some plantations. Many districts had more occupied nests in July than in June.

It is hoped to gain a better knowledge of the distribution of the nesting colonies throughout Great Britain in order to understand how they came to exist. The life of a wood-pigeon is long, but it is desired to know how long and how it varies with different types of woodland. The breeding season of the wood-pigeon does not necessarily coincide with that of other woodland birds. The possible connexion between late breeding and the formation of colonies is to be investigated. In the winter countryside, as in the nesting season, the wood-pigeon population is not evenly distributed. The filling in of record cards of winter flocks can give their distribution month by month, as well as their autumn, winter and spring movements, and a seasonal guide to feeding-grounds and flock sizes, favourite feeding hours and the relative number of stock doves feeding in the flocks. A collection of photographs is also being built up of nests, crop damage, and 'colony' woods.

## Biology of Oysters

THE oysters of Australia are being thoroughly investigated by the Division of Fisheries, Council for Scientific and Industrial Research. In the first of the series of pamphlets on the biology and cultivation of oysters in Australia, G. A. Kesteven wrote on some economic aspects (Pamphlet No. 105; 1941). A more recent publication, in two parts, is by G. Humphreys (2. A Note on the Calcium Content of Some East Australian Waters; 3. Biochemistry of the Proximal Constituents. Commonwealth of Australia. Council for Scientific and Industrial Research, Division of Fisheries. Report No. 7. Pamphlet 111. Melbourne, 1941). The calcium content of a number of oyster-growing waters has been investigated and the relation between condition and the fluctuation in the proximate constituents of the oyster, namely, carbohydrate fat and protein. It is concluded that there is no essential difference in calcium content between waters where oyster growth is normal and waters where only stunted growth appears. Opinions differ as to the role of glycogen in the oysters, some maintaining that it determines fatness, others that it is a reserve food material. The author shows that the latter view is correct, for the fattest oysters occur just before spawning when the glycogen percentage is at its minimum. The idea, supported by recent investigators, that glycogen is stored as a reserve food material and is used for the formation of gonad products which do not consist of glycogen is borne out by the figures presented, in which it is seen that for healthy oysters the glycogen percentage is in the range 3–7 during most of the year, but that just when the oysters are about to spawn, the value is below 2. It is found that oysters can be dried with no loss of glycogen or protein.

## Impregnating Varnishes

W. J. KIERNAN points out in a recent article (*Bell Lab. Rec.*, **20**, No. 12; August 1942) that until the recent development of synthetic resins and drying oils the impregnants applied to coils contained linseed or china-wood oils and natural resins, and that they 'set' by surface oxidation, leaving the interior in a semi-fluid state. Fatty acids were usually present in the unset portion, sometimes in sufficient strength to corrode copper. Varnishes made with synthetic resins of the phenol-aldehyde type polymerize on drying rather than oxidize, and produce a solid state throughout their mass. Corrosive tendencies are negligible or entirely absent

because of their complete setting and low acid content. When thoroughly dried by baking at high temperatures, they are no longer thermoplastic. This allows coils to operate at higher temperatures without softening the impregnating material and permits substantial savings by reducing the size of the coils. The penetrating power of these synthetic resins and their high dielectric strength make them particularly valuable for high-voltage circuits where corona discharges might occur and, by oxidizing the nitrogen, produce nitric acid which breaks down the coil insulation. Retardation coils and power transformers of several types, designed for telephone apparatus, are now being impregnated on a production basis with synthetic resin varnishes. The results indicate advantageous possibilities for their wider use.

## Tuberculosis Control in Argentina

ACCORDING to Dr. Hugo J. D'Amato, secretary of the National Department of Health of Argentina (*Bol. Of. San. Panamer.*, **21**, 772; 1942), family contacts have been examined in the last few years at the tuberculosis dispensaries of this department in order to discover unrecognized cases. As this procedure, however, did not include extra-familial contacts a new organization is being planned which will involve systematic and repeated examinations of the entire population. At present all public employees and all applicants for Government positions have to undergo clinical and radiological examinations of the thorax as well as tuberculin tests. Of 10,863 persons examined 104 were rejected and 51 were accepted with a temporary certificate while under treatment. Only six of the 10,708 applicants declared to be healthy or 60 per 100,000 have developed tuberculosis in the course of two years, whereas before examination was made compulsory the rate of infection was 520 per 100,000. In August 1941 the National Commission of Tuberculosis was created, which besides centralizing the administration of the tuberculosis control campaign, has power to propose measures regarding salaries, housing, nutrition and industrial hygiene.

## Earthquakes Registered in Switzerland

DURING July and August 1942, thirty earthquakes were registered by the instruments at the Swiss observatories of Zurich, Chur, Basel and Neuchâtel (*Swiss Earthquake Bull.*, No. 146 and No. 147). The distant earthquakes have, for the most part, been mentioned previously in the columns of NATURE, but the local earthquakes have not. On July 1 an earthquake was felt with intensity V (Rossi-Forel scale) in the Pays d'Enhaut. It was registered at Zurich at 23h. 43m. 13·3s., the epicentre being some 135 km. distant. On July 17 an earthquake was registered at Chur at 10h. 27m. 08·8s., which had its epicentre in the Schwäbische Alb, and on July 18 an earthquake registered at Basel at 15h. 46m. 08·3s. had its epicentre less than 10 km. to the north-west of that station. The earthquake of August 27, registered at Zurich at 11h. 11m. 21·9s., had its epicentre 70 km. from that station and was felt in the neighbourhood of the Brünig and Lungernsee. Finally, the earthquake of August 28, registered at Zurich at 11h. 28m. 58·4s., had its epicentre 71 km. from that place and was felt with intensity V in the neighbourhood of the Hohenstollen.

## An Important Binary Star System

DR. R. M. PETRIE, of the Dominion Astrophysical Observatory, Victoria, B.C., reports the discovery of another sub-dwarf star, a component of the binary system *HD* 144208–9 (*Sky and Telescope*, August). The primary in the system is of class *G* and the dwarf is of class *A* and a normal object for its class. Its luminosity in terms of the primary was determined from the combined spectrum of the two stars, in which the metallic lines and the *K* line of calcium are weaker than normal, and the wings of the Balmer hydrogen are stronger. The assumption that the primary obeys the mass-luminosity relation—mass proportional to absolute magnitude—made it possible to determine the masses and mean densities of both stars. Many other binary systems exist in which the components are *G*- and *A*-type, and the investigation of these systems is important that more may be understood about the relationship of the sub-dwarfs to the white dwarfs.

## A Radiological Library

A RADIOLOGICAL library valued at £3,500 is on sale by the Museum Book Store, 45 Museum Street, W.C.1, by whom a 12-page pamphlet is issued. This world-wide collection of journals and periodical publications, each in the language of its origin, is not likely to be duplicated, and it is hoped that it will find its way into some research laboratory or radiological centre. The chief publishers of radiological subjects have been the United States, Germany, France and Great Britain, and we can think of no X-ray or radium journal which is not included in this library. This offer of sale has now been open for some months and the step of acquiring the valuable collection waits to be taken by some authority with vision as well as money.

## Prof. F. H. Garner

THE chair of oil engineering and refining in the University of Birmingham, rendered vacant by the death of Prof. A. W. Nash, has been filled by the appointment of Dr. F. H. Garner, a graduate of the University (1914). Dr. Garner was for many years chief chemist of the Anglo-American Oil Co. and is that company's principal scientific officer in Great Britain; he has a high reputation and an excellent record as a research chemist in the field of oil chemistry. He has acted as an external examiner in the Oil Engineering Department of the University of Birmingham for several years and has thus a knowledge of the working of the Department.

## Announcements

THE Emil von Behring prize, which is awarded by the University of Marburg every two years for outstanding achievements in immunology, serum therapy and chemotherapy, has been awarded to Prof. Paul Uhlenhuth, professor of hygiene and bacteriology in the University of Freiburg-im-Breisgau.

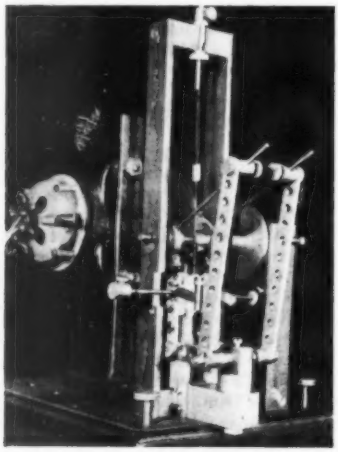
WE have received *Abstracts of Articles and Patents on the Production of Glycerol by Fermentation* published by the National Research Council of Canada, Ottawa, 1942, which contains abstracts of 109 articles and 114 patents on this subject. The publication is N.R.C., No. 1070, price 50 cents.

# LETTERS TO THE EDITORS

*The Editors do not hold themselves responsible for opinions expressed by their correspondents. No notice is taken of anonymous communications.*

## Scaliness of Animal Fibres

ONE of the most important properties of wool fibres is their ability to migrate in the direction of the root end when rubbed, especially in presence of a solution of soap or acid. With fabrics and masses of loose fibre, migration takes place in much the same way as a worm crawls[1], and is due primarily to the surface scale structure of the fibres. This peculiarity is turned to advantage in the manufacture of felts,



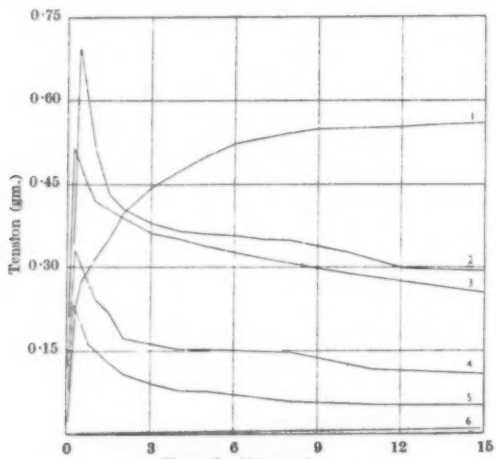
and to meet an obvious need, a method of measuring the scaliness of different types of fibre was devised some years ago[2]. It consists in mounting fifty fibres in parallel, with the scales all pointing in one direction, and then measuring the frictional resistance to motion towards the root ends and towards the tips of the fibres. The observed difference in (static) friction in the two directions gives a measure of scaliness. Although the method has given useful results, it suffers from a number of defects. Besides being tedious in use, it gives no opportunity of studying the properties of individual fibres, and is not very closely related to the practice of felting, where dynamic friction is operative.

To overcome these defects, a new method of measuring scaliness has been evolved. The apparatus is shown in the illustration. A single fibre, with the tip-end uppermost, is rubbed at a standard rate between two opposed, reciprocating, plane surfaces under controlled pressure, the surfaces being clothed with silk bolting-gauze or other suitable material. The fibre creeps downwards against a gradually increasing tension in the calibrated spring, to which its tip-end is attached. A measure of scaliness is given by the rate of increase of tension and by the maximum tension developed, allowance being made, if necessary, for variations in fibre diameter.

Typical curves showing the rate of development of tension with various fibres are reproduced. They reveal an interesting phenomenon. Whereas the maximum tension developed in the case of human hair is maintained over long periods of rubbing, the various wools examined show a rapid fall in tension as soon as the maximum has been attained. Besides possessing different degrees of scaliness, therefore, animal fibres clearly vary in their resistance to abrasion. Both factors, the second of which has hitherto been neglected, must play a part in determining the felting power of different wools, and their mode of operation under different conditions of humidity, temperature and *p*H is now being studied with the new apparatus.

N. H. CHAMBERLAIN.
J. B. SPEAKMAN.

Textile Chemistry Laboratory,
University, Leeds.
Oct. 17.




1, Human hair. 2, New Zealand Romney wool. 3, Lincoln wool. 4, Cotswold wool. 5, Mohair. 6. Kemp (from Blackface fleece).

[1] Arnold, *Leipziger Monats. für Textilind.*, **44**, 463, 507, 540 (1929); Speakman, Stott and Chang, *J. Text. Inst.*, **24**, T273 (1933).

[2] Speakman and Stott, *J. Text. Inst.*, **22**, T339 (1931).

## Vitamin Requirement of the American Flour Beetle *Tribolium confusum* Duval

THE larvæ of the American flour beetle *Tribolium confusum* Duval can only develop on a diet consisting of protein, carbohydrate, salts, and water if yeast or some other suitable vitamin source is added[1]. Fröbrich[2] found the addition of 5 per cent of dry yeast to a diet of casein, rice starch and Osborne-Mendel salt mixture in a relative humidity of 70–75 per cent to be sufficient. For the activity of the yeast extract thiamine, riboflavine, and an unknown factor $B_x$ were important; in the insoluble fraction there were recognized as necessary ergosterol (which could be replaced completely by cholesterol) and a further unknown factor, U. Offhaus[3] obtained similar results with a diet of dried egg-white, rice starch, and di-potassium hydrogen phosphate, but found that the insoluble yeast fraction could be completely replaced by cholesterol + histidin. Fraenkel and Blewett[4] have also investigated this problem.

During the past two years we have carried out experiments with Tribolium larvæ, which have furnished somewhat different results. One-day-old larvæ in groups of five were kept at 34° in a relative

TABLE 1.

| Diet: 1·5 gm. given | No. of animals observed | Results after 22 days: Larvæ | Pupæ + Adults | Dead | Growth response |
|---|---|---|---|---|---|
| (*a*) Wholemeal | 5<br>5 | –<br>– | 5<br>5 | –<br>– | Good |
| (*b*) Deficient diet | 5<br>5 | 5<br>5 | –<br>– | –<br>– | None |
| (*c*) Deficient diet + 75 mgm. dry yeast | 5<br>5 | –<br>– | 5<br>5 | –<br>– | Good |
| (*d*) Deficient diet + 37 mgm. insoluble yeast | 5<br>5 | 5<br>5 | –<br>– | –<br>– | None |
| (*e*) Deficient diet + 37 mgm. yeast extract | 5<br>5 | 5<br>5 | –<br>– | –<br>– | None |
| (*f*) Deficient diet + 37 mgm. insoluble yeast + 37 mgm. yeast extract | 5<br>5 | –<br>– | 5<br>5 | –<br>– | Good |

humidity of 70–75 per cent on 1·5 gm. of a deficient diet, and the pupæ counted after 22 days. The deficient diet consisted of 20 per cent casein (vitamin-free), 75 per cent rice starch, and 5 per cent McCollum salt mixture. Dried brewer's yeast was boiled for 2 hours with 5 parts of distilled water, the treatment repeated nine times, and the insoluble fraction dried. The united aqueous extracts were largely evaporated *in vacuo*, alcohol added to give an alcohol content of 80 per cent, the precipitate removed, and the clear filtrate evaporated *in vacuo* and dried (yeast extract).

TABLE 2.

| Diet: 1·5 gm. given | No. of animals observed | Results after 22 days: Larvæ | Pupæ + Adults | Dead | Growth response |
|---|---|---|---|---|---|
| (*a*) Wholemeal (control) | 5<br>5 | –<br>– | 5<br>5 | –<br>– | Good |
| (*b*) Deficient diet + 35 mgm. insoluble yeast + 10 addenda* | 5<br>5 | –<br>– | 5<br>5 | –<br>– | Good |
| (*c*) Deficient diet + 37 mgm. insoluble yeast + 3 addenda** | 5<br>5 | –<br>– | 5<br>5 | –<br>– | Good |
| (*d*) Deficient diet + 35 mgm. insoluble yeast + 2 vitamins*** + 0·25 γ biotin (pure) | 5<br>5 | –<br>– | 5<br>5 | –<br>– | Good |
| (*e*) Deficient diet + 35 mgm. insoluble yeast + 2 vitamins*** (without biotin) | 5<br>5 | 5<br>5 | –<br>– | –<br>– | None |
| (*f*) Deficient diet + 100 γ cholesterol + 3 addenda** | 5<br>5 | –<br>– | 5<br>4 | –<br>1 | Good |
| (*g*) Deficient diet + 100 γ cholesterol + 2 vitamins*** + 0·25 γ biotin (pure) | 5 | – | – | 5 | None |

* 10 Addenda : 10 γ thiamine, 8 γ riboflavine, 10 γ pyridoxine, 5 γ calcium pantothenate, 500 γ nicotinic acid amide, 2 mgm. *meso*-inositol, 1 γ *p*-aminobenzoic acid, 10 mgm. $SiO_2$, 10 γ KI, 15 mgm. biotin preparation from liver (= 0·3 γ pure biotin).

** 3 Addenda : 10 γ thiamine, 500 γ nicotinic acid amide, 15 mgm. biotin preparation from liver (= 0·3 γ pure biotin).

*** 2 vitamins : 10 γ thiamine, 500 γ nicotinic acid amide.

The separation of the active constituents was complete (Table 1).

It was then found that the 37 mgm. of yeast extract could completely be replaced by a mixture* (Table 2, *b*) of the ten components of which only the biotin preparation was non-homogeneous. By omitting individual components it was shown that two pure vitamins**, namely, thiamine and nicotinic acid amide, together with 15 mgm. of a biotin preparation (= 0·3 γ biotin) were sufficient (*c*). The biotin preparation in this combination*** could be replaced by an equivalent quantity of pure biotin (*d*), the necessity of which was again demonstrated (*e*).

By using the three-component mixture** as the vitamin source, the insoluble yeast fraction could completely be replaced by 100 γ cholesterol (*f*); this could not be accomplished by use of the two crystalline vitamins*** with pure biotin (*g*). Thus the water-insoluble yeast fraction contains at least one other factor which is necessary for the development of Tribolium, and which is also present in our biotin preparation from liver.

Our results confirm the necessity of biotin, but differ sharply from those of Fraenkel and Blewett. This difference could arise from the different basic diets or from the different animal strains employed. The circumstance that our experiments and possibly those of the other authors were not conducted under aseptic conditions appears to us more important; thus, although no sign of infection was observed, living micro-organisms in the digestive tract could play an important part as producers of vitamins. One of us (H. R.) desires to acknowledge the assistance of the "Roche" Studien Stifting, which enabled him to take part in this work.

H. ROSENTHAL.
T. REICHSTEIN.

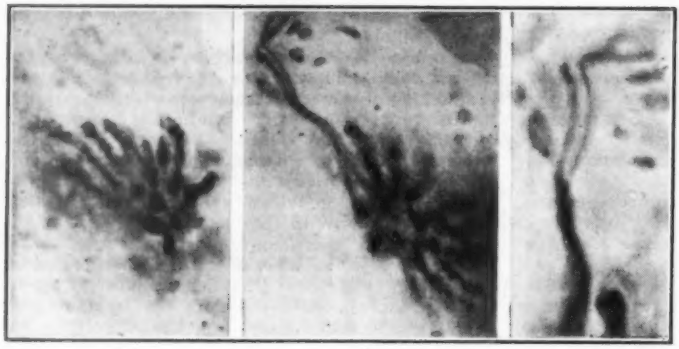
Pharmazeutische Anstalt der Universität,
Basel. Oct. 1.

[1] Sweetman, M. D., and Palmers, L. S., *J. Biol. Chem.*, **77**, 33 (1928).
[2] Fröbrich, G., *Z. vergl. Physiologie*, **27**, 335 (1939).
[3] Offhaus, K., *Z. vergl. Physiologie*, **27**, 384 (1939).
[4] Fraenkel, G., and Blewett, M., NATURE, **150**, 177 (1942).

## Demonstration of the Telophase Split in Todea

THE time of chromosome splitting in a normal cell division is, and has long been, one of the most hotly controversial topics in the whole of cytology. Two extreme views hold sway. According to one, a chromosome is single at all stages of mitosis except prophase and metaphase, the split itself occurring at the end of rest (cf. Darlington[1], White[2], and others). According to the other, a chromosome is at no time single, the prophase split being already formed at the preceding telophase or earlier; indeed in some plants with large chromosomes, notably Trillium and Tradescantia, both pro- and telophases have recently been described as visibly quadripartite (cf. Nebel[3] for the most recent available summary of this point of view).

Historically, both views go back to the last century, as may conveniently be seen by comparing early and late editions of a classic handbook such as that of Wilson on the cell[4]. Throughout this period the factual basis of both views has suffered repeated confusion and contradiction owing to uncertainties in other fields; ignorance of the facts of spiral structure and preliminary difficulties regarding the morphology of chromosome pairing being two of the



*a* *b* *c*

PHOTOMICROGRAPHS OF SISTER NUCLEI NEAR THE CLOSE OF A MITOSIS IN A YOUNG PROTHALLUS OF *Todea barbara*, FROM A LIQUID MOUNT IN ACETOCARMINE. *a* AND *b* × 2000; *c* × 4000.

most outstanding causes of conflict. The controversy is of importance because its solution is indispensable to a clear understanding of many larger problems involving a knowledge of chromosome structure. The literature is far too voluminous to be quoted in detail though a guide to it will be found in the works above cited; but the present position may perhaps be summarized by the statement that the older and simpler 'prophase split' view is the one more frequently expressed by modern British writers though, perhaps significantly, the most emphatic expositions of it are to be found in works with a strongly theoretical bias. On the other hand, the observations carried out in the last decade on spiral structure of chromosomes, especially in Japan and in America, has led an increasing number of observers in those countries to accept the theoretically more complex 'telophase split' view.

A problem such as this can scarcely be approached with profit except in relation to new and incontrovertible evidence. Some evidence of this kind is thought to be contained in the accompanying photographs.

The photographs are from a cell near the close of the third division in the germinating spore of the fern *Todea barbara*. The specimen had been treated for spiral structure, fixed in acetic alcohol overnight and then mounted and squashed out of its cell wall in a drop of warm acetocarmine by momentary pressure on the coverslip. It was observed and photographed in this reagent after ringing the preparation, but was afterwards successfully brought into Canada balsam and is still available for study.

In the accompanying illustration, *a* represents the upper of two sister plates of chromosomes at late anaphase or early telophase. Beyond traces of spiral structure which will be described elsewhere it shows nothing remarkable. *b* represents the corresponding, lower, plate of chromosomes. It lies at a deeper focal level and appears to have encountered some mechanical impediment in the act of squeezing out of the torn cell wall, for two chromosomes (now lying somewhat across each other in the top left-hand corner of the picture) have been violently distorted by stretching. In one of these (the apparently longer) not only has the spiral become almost effaced by this process but also, more important, for a considerable distance near its end, two distinct and separate threads have been forced widely asunder. The significant part of this chromosome is shown at a higher magnification in *c*.

While freely admitting that the ease of separation of the two threads in this chromosome is likely, in part, to be due to the treatment, I find it impossible to believe that the split itself is an artefact, it being remembered that until the pressure was applied to the coverslip the chromosome was in the form of a complex spiral. I am therefore of opinion that this one specimen is conclusive evidence that the telophase split is a reality for the plant under investigation.

Further discussion of this and other conclusions to which the specimen gives rise will be dealt with elsewhere.

I. MANTON.

Botany Department,
University of Manchester.

[1] Darlington, C. D., "Recent Advances in Cytology", second edition (London, 1937).

[2] White, M. J. D., "The Chromosomes" (London, 1937).

[3] Nebel, B. B., "Structure of Trillium and Tradescantia Chromosomes with Particular Emphasis on the Number of Chromonemata", Cold Spring Harbor Symposia on Quantitative Biology, **9**, 7–12 (1941).

[4] Wilson, E. B., "The Cell in Development and Inheritance" (London and New York. First edition (1897); third edition (1925)).

## A Water-soluble Carcinogen Derived from 3 : 4-Benzpyrene

IN a note entitled "Photo-oxides of Carcinogenic Hydrocarbons", an account has already been given of the labile water-soluble materials produced from 3 : 4-benzpyrene by irradiating it in solution in benzene, and of some biological effects produced by them[1]. Similar materials were shown by Schulman and Rideal to be adsorbed on protein monolayers[2], and by analogy with their work on œstrogenic and hæmolytic substances, it appeared possible that the existence of such water-soluble derivatives might throw light on the mechanism by which tumours are produced by the insoluble parent hydrocarbon. Further investigation of the optimum conditions for the irradiation, in collaboration with Dr. B. Szigeti, of the Research Department of Messrs. Adam Hilger Limited, has made it possible to prepare more concentrated extracts from irradiated benzpyrene than were used in the earlier experiments, and these have proved to be carcinogenic.

1·5 ml. of a 1 per cent solution of 3 : 4-benzpyrene in benzene was diluted to about 20 ml. with a mixture of benzene and cyclohexane containing upwards of 20 per cent of benzene. (In view of the restriction of supplies of the pure solvents, the exact proportions have had to be decided on the basis of the materials available. Optimum results are obtained with 20 per cent benzene.) This solution was irradiated for 30 minutes in an open dish 260 cm.$^2$ in area placed immediately below a neon-sensitized mercury lamp which gives almost pure monochromatic ultra-violet light of wave-length 2537 A.$^3$. The remaining solvent was evaporated quickly in a current of air, and the dry residue was extracted with about 4 ml. of *M*/100

sodium bicarbonate solution. The extract was filtered free from unchanged benzpyrene and from insoluble products of the irradiation.

0·15 ml. of the filtrate was brushed into an area 2 cm. in diameter on the backs of ten mice from a stock in which no spontaneous tumours have occurred over a period of several years. 260 paintings have been given in fifty-four weeks. Five mice have developed tumours on the painted site, and in four cases so far examined histologically, these consisted of multiple keratinizing squamous cell carcinomas with small papillomas.

In order to exclude the possibility that the effect might be caused by the passage of colloidal benzpyrene through the filter, ten control mice have been painted simultaneously with a solution prepared in the same way but without the irradiation. The control has also been weighted against the experiment by adding acetone to the solution to ensure its rapid penetration into the skin. Five of the control animals have been examined (up to fifty-four weeks of painting): none of them has shown any cancerous or precancerous condition. It may therefore be concluded that the aqueous extract from 3 : 4-benzpyrene contains a carcinogen which is not the hydrocarbon itself.

This conclusion is supported by evidence obtained in experiments in which mice previously sensitized by applying a solution of benzpyrene in benzene have been painted on the same site either with the aqueous extract or, for control, with bicarbonate solution. Twenty out of twenty-eight experimental mice have developed tumours in periods varying from thirty-eight to fifty-four weeks of painting as compared with four of the twenty-eight control animals.

It is impossible at present to identify the active compound. The aqueous extract contains two main substances characterized, at *p*H 8, by absorption bands at 3600 A. and 2760 A. respectively, but all attempts to isolate them have led to decomposition. Similar—possibly identical—substances have been detected in the products of irradiation, under the same conditions as were described in the earlier note[1], of cholanthrene, 1 : 2 : 5 : 6-dibenzanthracene, phenanthrene, anthracene and of naphthalene. The absorption spectra exclude the possibility that they are either photo-oxides[4], mono- or dihydroxy derivatives[5], or of the stilbene type[6].

This work has been maintained by grants from the Medical Research Council, to which I express my indebtedness. I also thank Dr. H. B. Fell and Prof. E. K. Rideal for their continual advice and interest, and Dr. A. Glucksmann for undertaking the histological examination of all the material.

C. B. ALLSOPP.

Strangeways Laboratory,
and
University Department of Colloid Science,
Cambridge.
Oct. 17.

[1] Allsopp, C. B., NATURE, **145**, 303 (1940).
[2] Schulman, J., and Rideal, E. K., NATURE, **144**, 100 (1939).
[3] Melville, H. W., *Trans. Faraday Soc.*, **32**, 1525 (1936).
[4] Cook, J. W., *et al.*, NATURE, **143**, 1020 (1939); *J. Chem. Soc.*, 1125 (1940).
[5] Cf. Chalmers, J. G., *Biochem. J.*, **34**, 678 (1940). Boyland, E., *et al.*, *Biochem. J.*, **35**, 184 (1941); etc.
[6] Cf. Dodds, E. C., *et al.*, NATURE, **148**, 142 (1941).

## Lichenin

THE introduction of cross-linkages into soluble synthetic linear high polymers is followed by a decrease in solubility. In Nature, an interesting parallel appears to be afforded on one hand by the water-soluble polysaccharide lichenin, which consists of an unbranched β-glucopyranose chain $(C_6H_{10}O_5)_n$ where $n = 80–160$ [1, 2] and by cellulose on the other, if for the latter the structure of β-glucopyranose chains (or multi-membered loops) linked at intervals by cross-linkages[3] be accepted. This communication contributes to the question of the structural difference between lichenin and cellulose.

It has been shown previously[4] that treatment of potassium hydroxide-cellobiose with dry methyl sulphate followed by hydrolysis yields 2-methyl- and 2 : 6-dimethyl glucose whereas potassium hydroxide-cellulose when treated in this way yields 2-methyl glucose, but no 6-methyl or 2 : 6-dimethyl glucose[5]. This seems to indicate that in cellulose the primary alcohol residues are not vulnerable to attack under these mild conditions, and is evidence that the primary alcohol residues are the most likely to be involved in some form of cross-linking between the chains.

We have now shown that lichenin can combine with one molecular proportion of potassium hydroxide for each anhydroglucose unit to form an unstable addition compound, but that both 2- and 6-methyl glucose are present in the products of hydrolysis after methylation under anhydrous conditions. This result may be interpreted as showing that the primary alcohol groups in lichenin are not shielded as in cellulose and is in harmony with the results of Carter and Record[1] who, by their osmometric measurements on acetylated and methylated lichenins, show that the 'physical' molecular weight is of the same order as that found by end-group assay; that is, there is no aggregation of primary chains by cross-linkages, and thus agrees with the suggestion of W. N. Haworth[3].

E. G. V. PERCIVAL.
H. GRANICHSTÄDTEN.

King's Buildings,
University of Edinburgh.
Oct. 19.

[1] Carter and Record, *J. Chem. Soc.*, 664 (1939).
[2] Hess and Lauridsen, *Ber.*, **73**, 115 (1940).
[3] Haworth, *Chem. and Ind.*, 917, (1939).
[4] Percival and Ritchie, *J. Chem. Soc.*, 1160 (1934).
[5] Heddle and Percival, *J. Chem. Soc.*, 1690 (1938); *ibid.*, 249 (1939).

## Artificially Induced Loss of Theta-Toxin Production by *Clostridium welchii* Types A and C

Macfarlane and Knight[1] having shown fairly conclusively that the alpha toxin of *Cl. welchii* Type *A* is a lecithinase, we considered it possible that repeated passage through media containing lecithin might enhance the capacity to produce alpha toxin. However, we found that after a dozen rapid passages through Hall's cooked-brain medium, strains showed no loss of capacity to produce alpha toxin when grown in 'test medium' (V.F. broth plus 0·25 per cent glucose), as compared with the same strains after similar passaging through test medium, but that they unexpectedly lost the capacity to produce theta toxin. It would thus appear possible to produce large

quantities of *Cl. welchii* toxins free from theta toxin, much more simply than by the procedures described by van Heyningen[3]. Strains of *Cl. welchii* Type *C*, which normally produce considerable amounts of theta toxin (up to 1,000 H.U. per ml.), behaved in the same way.

It is of some interest to note that this procedure did not at all affect the capacity of Types *A* and *C* to produce proteinase. This suggests that theta toxin is not identical with the gelatinolytic proteinase, which, like it, is activated by cysteine.

A. W. TURNER.
CATHARINE EALES.
A. W. RODWELL.

Council for Scientific and Industrial Research,
Division of Animal Health and Nutrition,
Animal Health Research Laboratory,
Melbourne, N.2.
June 26.

[1] Macfarlane, M. G., and Knight, B. C. J. G., *Biochem. J.*, **35**, 884 (1942).
[2] van Heyningen, W. E., *Biochem. J.*, **35**, 1257 (1942).

## The E.M.F. of Thermal Fluctuations in Resistances

THE formula giving the mean-square E.M.F. of thermal fluctuations per cycle, in a resistance $R$ at temperature $T$, namely:

$$\overline{e_\nu^2} = 4.R.k.T, \quad . \quad . \quad . \quad . \quad (1)$$

was first derived by Nyquist[1] by thermodynamical reasoning.

J. Bernamont[2] has derived formula 1 from the corpuscular point of view, using the Lorentz theory of electrons. The mechanism of the conductivity by free electrons was considered, both with the classical statistics of Boltzmann and the quantum statistics of Fermi-Dirac.

C. J. Bakker and G. Heller[3] have shown that to specify Boltzmann or Fermi-Dirac statistics is unnecessary and that equation 1 can be obtained by application of the most general statistical consideration. The following derivation of (1), using macroscopical considerations for conductors satisfying Ohm's law, is based on the equipartition of energy.

Consider a conductor, the total charge of which is zero, with no applied external electric field. Though on the average the total charge is zero, the density of charge at any point in the conductor may fluctuate; an excess of negative charge at one point is counterbalanced by an excess of positive charge at some other point or points of the conductor. The 'equation of continuity', using the rationalized system of units, is:

$$\nabla.\vec{J} + \frac{\partial \rho}{\partial t} = 0, \quad . \quad . \quad . \quad (2)$$

where $\vec{J}$ is the current density and $\rho$ is the density of charge. For conductors satisfying Ohm's law, we have:

$$\vec{J}_t = \sigma.\vec{E}, \quad . \quad . \quad . \quad . \quad (3)$$

where $\sigma$ is the conductivity and $\vec{E}$ is the intensity of the electric field. Equation 2 becomes:

$$\nabla.\sigma\vec{E} + \frac{\partial \rho}{\partial t} = 0. \quad . \quad . \quad . \quad (2a)$$

If the conductor is homogeneous and isotropic, then:

$$\nabla.\vec{E} = \frac{1}{\varepsilon}\rho, \quad . \quad . \quad . \quad . \quad (4)$$

where

$$\varepsilon = \varepsilon_0 K_0 \quad . \quad . \quad . \quad . \quad (5)$$

is the specific inductive capacity of the medium, $\varepsilon_0$ is relative to free space, and $K_0$ is the dielectric constant. Combining equations 2*a* and 4, we have:

$$\nabla\left(\frac{\partial\vec{E}}{\partial t} + \frac{\sigma}{\varepsilon}\vec{E}\right) = 0. \quad . \quad . \quad . \quad (6)$$

We are interested only in the time dependence of $\vec{E}$, and as the conductor is homogeneous and isotropic, we take as solution of equation 6:

$$\frac{\partial\vec{E}}{\partial t} + \frac{\sigma}{\varepsilon}\vec{E} = 0, \quad . \quad . \quad . \quad (7)$$

the integration constant being zero, since the applied external field is zero. (The final results are valid for a constant external field.)

Equation 7 is interpreted as follows: owing to the fluctuations of the density of charge, there results a fluctuating electric field. If at any instant the field is $E_0$, it will decay according to equation 7 with a time constant $\tau = \varepsilon/\sigma$, which is exceedingly small, namely, $2 \times 10^{-10}$ sec. for sea water and $2 \times 10^{-17}$ sec. for copper.

Using equation 7 to form the 'correlation function' $\overline{EE_t}$, one has[2] for $t > 0$:

$$\overline{EE_t} = \overline{E^2}.\exp\left(-\frac{\sigma}{\varepsilon}.t\right). \quad . \quad . \quad (8)$$

The 'spectral component of intensity' for 'infinitely brief' correlations, that is, for frequencies $\nu << \frac{1}{2\pi\tau}$, we have

$$\overline{E_\nu^2} = 4\overline{E^2}\int_0^\infty \exp(-\frac{\sigma}{\varepsilon}.t).dt = 4.\frac{1}{\sigma}.\varepsilon\overline{E^2}. \quad . \quad (9)$$

Assuming the conductor is cylindrical, of section $s$ and length $l$, then

$$\overline{E_\nu^2} = \frac{4}{\sigma.s.l}.\varepsilon\overline{E^2}.s.l. \quad . \quad . \quad . \quad (10)$$

$\varepsilon.\overline{E^2}.s.l$, in the system of units used, is the total mean energy of the electromagnetic field. Allowing $\frac{1}{2}kT$ per degree of freedom (the electric and the resulting magnetic fields) then:

$$\overline{E_\nu^2} = \frac{4}{\sigma.s.l}.kT. \quad . \quad . \quad . \quad (11)$$

Finally, the mean-square E.M.F. of fluctuations per cycle, across the ends of the cylindrical conductor, is:

$$\overline{e_\nu^2} = \overline{E_\nu^2}.l^2 = \frac{4l}{\sigma.s}.kT = 4R.k.T, \quad . \quad (12)$$

where $R = \frac{l}{\sigma.s}$ is the resistance of the conductor.

M. SURDIN.

Craig House,
Marmion Avenue,
Southsea, Hants.
Oct. 5.

[1] Nyquist, H., *Phys. Rev.*, **32**, 110 (1928).
[2] Bernamont, J., *Ann. Phys.*, **7**, 71 (1937).
[3] Bakker, C. J., and Heller, G., *Physica*, **6**, 262 (1939).

## Energy-Level Treatment of Reaction Data

IN a recent paper[1] it was shown that satisfactory explanations of certain aromatic side-chain reaction data are provided by correlation of the alterations in electron density which arise from the various electron displacements (inductive, inductomeric, mesomeric and electromeric) of the substituents with the energy-levels in the initial, transition and final states of the reaction. Such changes, relative to the energy-levels in the unsubstituted parent molecule as a reference standard, were represented by assigning arbitrary numerical values to each polar effect and thus obtaining a quasi-quantitative expression of their resultant effects on the activation energy of the reaction.

In the absence of data regarding the absolute magnitudes of the various polar effects such numerical values were, of necessity, somewhat arbitrary and in unknown units, although both in their signs and *relative* magnitudes, they satisfied the known order of electron release or attraction by the various mechanisms.

A recent paper by Audsley and Goss[2] has now provided reliable values for the primary ($\mu_P$), induced ($\mu_I$) and mesomeric ($\mu_M$) dipole moments of the four monohalogenobenzenes. This data should provide at least approximately *quantitative* values for the corresponding electron displacements in the reaction previously used as an illustration[1], namely, the Menschutkin reaction

$$p\text{-}X.C_6H_4.CH_2.Br + C_5H_5N \rightarrow X.C_6H_4.CH_2.\overset{+}{N}C_5H_5\}\overset{-}{B}r.$$

The only magnitudes which must still remain hypothetical are those ($a$) of the electromeric ($+E$) effect and ($b$) of the reduction in the inductive ($-I$) effect, of the halogen substituent in the transition state. Changes in energy-levels due to permanent polarization effects will be proportional to some (unknown) constant multiplied by $\mu$. Using the same values for the two unknowns as those previously employed, but substituting the values of $10^2\ \mu$ (which give whole numbers of convenient magnitudes) for the various permanent polarizations, the following results are obtained:

RELATIVE ENERGY-LEVELS IN THE REACTION

$$p\text{-}X.C_6H_4.CH_2.Br + C_5H_5N \rightarrow X.C_6H_4.CH_2.\overset{+}{N}C_5H_5)\overset{-}{B}r$$

| | Reduction in energy-levels in the ground state | | | | Reduction in energy-levels in the transition-state | | | | | $E_g - E_0$ |
|---|---|---|---|---|---|---|---|---|---|---|
| $X$ | $\mu_P$ | $\mu_I$ | $\mu_M$ | Total (Eg.) | $\mu_P$ | $\mu_I$ | $\mu_M$ | $E$ | Total (Eg) | Reference standard |
| H | — | — | — | — | — | — | — | — | — | |
| Cl | −184 | −75 | +95 | −164 | −184 | −74 | +95 | +2 | −161 | −3 |
| Br | −172 | −70 | +74 | −168 | −172 | −69 | +74 | +4 | −163 | −5 |
| F | −176 | −72 | +104 | −144 | −176 | −65 | +104 | ~0 | −137 | −7 |
| I | −156 | −64 | +51 | −169 | −156 | −63 | +51 | +7 | −161 | −8 |

It will be seen that the new values predict exactly the same order for the velocities of the various $p$-halogenobenzyl bromides as that previously indicated, namely, activation energies decreasing in the order H > Cl > Br > F ≈ I, in agreement with the experimental velocity sequence I ≈ F > Br > Cl > H.

This agreement, using magnitudes which have a definite physical basis, strongly supports the essential correctness of the whole method of energy level treatment of reaction data and also suggests that the numerical values assigned to the electromeric effects probably give an approximate estimate of the *relative* magnitudes of these effects for the halogen group of substituents.

J. W. BAKER.

The University,
Leeds.
Oct. 7.

[1] Baker, *Trans. Faraday Soc.*, **37**, 632 (1941); cf. Baker and Hemming, *J. Chem. Soc.*, 191 (1942).
[2] *J. Chem. Soc.*, 497 (1942).

## Agricultural Research Institutes and the Future

DR. B. A. KEEN'S article in NATURE of September 5, p. 282, does well to invite the attention of research workers to the possible future developments in agricultural education and research in Great Britain. It may be regretted that Dr. Keen sought to restrict his remarks to arable agriculture. I venture to hope, with Sir George Stapledon, that our future agriculture will be ley farming, and that most of our farmland will cease to be classifiable into the rigid categories of 'grass' and 'arable'. This, however, is a minor point.

Dr. Keen's suggestion for co-ordinated field experimentation may be warmly welcomed, and I would stress the importance of ensuring that research localities be carefully chosen to cover the principal classes of soil. Too often in the past, expensive and well-planned field experiments have been laid down without reference to soil type. Unfortunately, the national soil survey has not been in progress long enough for even a preliminary soil map to be made; but a considerable amount of information is available, and it would not be difficult to examine the suitability of proposed experimental areas in order to avoid the selection of non-typical sites.

Finally, although co-ordination of post-war agricultural research is inevitable, it may be hoped that the organization will not be too rigid. If a compromise is necessary between a system of complete freedom for the individual investigator and a totalitarian research system, let us err on the side of freedom even at the risk of a certain amount of overlapping.

G. W. ROBINSON.

University College of North Wales,
Bangor.

# RESEARCH ITEMS

### Insect Fauna of Lower California

THE peninsula of Lower California has an interesting insect fauna that has been long neglected by students. The terrain is possibly largely accountable, owing to the difficulties of collecting in such a desert region with its barely passable roads. It is consequently understandable that most insect collecting has been made in the Cape Region, which can be easily reached by boat. The California Academy of Sciences has been the leader in the biological exploration of Lower California but unfortunately its collections, made between 1888 and 1894, were largely destroyed in the great San Francisco earthquake and fire. Realizing the need for further collecting, Messrs. A. E. Michelbacher and E. S. Ross spent two months on the Peninsula in 1938 and the collections obtained seemed sufficiently large to make desirable the publication of a series of entomological reports in the *Proceedings of the California Academy of Sciences*. Of these reports six have already been published during 1942 up to June 20 and deal with an introductory account, the Cerambycidæ, Buprestidæ, Myrmelionidæ, Symphyla and Culicidæ. The authors are (respectively) A. E. Michelbacher and E. S. Ross, E. Gordon Linsley, E. C. Van Dyke, A. E. Michelbacher and T. H. G. Aitken. Several new species have been brought to light, particularly among the Cerambycidæ where they number 22 species out of a total of 116 species collected. From among the 58 species of Buprestidæ recorded eight are new and a similar number of new Myrmelionidæ are recorded.

### Parasites of Shisham Defoliators in the Punjab

*Indian Forest Records* (N.S. Entomology, **7**; 1942) contains a contribution entitled "On the Biology of the Parasites of the Shisham Defoliators in the Punjab Plantations" by R. N. Mathur with a note by C. F. C. Beeson. It appears that the defoliation of the shisham trees (*Dalbergia sissoo*) in the irrigated plantations presents several features of unusual ecological interest. The principal defoliators are caterpillars of the Noctuid moth, *Plecoptera reflexa* Guen., which, in turn, are attacked by 18 species of primary parasites. Defoliation by this insect, and certain other species, is epidemic annually because stands of poor-quality shisham on unsuitable sites form permanent foci of infection. Furthermore, stands of shisham that have not tapped the moisture-level in the deep subsoil come into leaf late. Also, shallow, frequent irrigation causes the defoliated trees to produce new foliage at a periodicity that conforms to the sequence of generations of *Plecoptera reflexa*. Defoliation can be controlled by restricting shisham to areas suitable for it and stocking unsuitable sites with other species. It is important to ensure that the taproots of shisham cuttings reach the subsoil moisture level in one or two seasons by means of deep controlled irrigation. Control of natural enemies follows automatically when stands are established under the foregoing principles. It is clear that the parasite population-density will be maintained at a higher level under improved conditions of shisham cultivation. Until such an improved environment is attained it is of little use attempting to introduce non-indigenous parasites as aids in the control of defoliators.

### Mouth-parts of a Weevil (*Calandra granaria*)

DR. R. DENNELL has given an account of the above subject together with the rostrum and fore-intestine (*Phil. Trans. Roy. Soc.*, **231**, 247; 1942). It is probable that many of his deductions will apply to numerous other weevils of similar behaviour. It appears that the mandibles are asymmetrical and possess a markedly oblique axis of rotation and by this means the action of the teeth becomes determined. The so-called pharyngeal bracons reach their highest degree of development in Calandra and its allies, where they form long slender rods that extend freely almost the whole length of the pharynx. They are attached to the mandible of their side and are wrapped around the tendon of the adductor muscle. The working of the molar teeth of the mandibles in an antero-posterior direction causes the pharyngeal bracons, that are attached closely behind them, to move to and fro in the pharynx. It is by the frequent repetition of these movements that the bracons are responsible for the progressive transport of the food along the pharynx. A median tract of spines in the pharyngeal roof, it may be added, co-operates in the backward passage of the food. The paper is fully illustrated and provides the first connected account of the functions of the bracons just alluded to.

### Histology of Mammalian Hair

THE importance of fibre histology in forensic science was pointed out, and processes involved in the identification of animal hair outlined by J. L. Stoves in a paper read to the Society of Public Analysts and other Analytical Chemists on October 7. Photomicrographs were shown to be of value for reference purposes and also as a means of presenting evidence in court. A description was given of new methods employed for the preparation of photomicrographs of (*a*) transverse sections, (*b*) longitudinal sections, (*c*) cuticular scale impressions. New features of apparatus were illustrated, and a number of photomicrographs shown demonstrating the histological features of various mammalian fibres.

### Biochemistry and Genetics

E. L. Tatum and G. W. Beadle (*Proc. Nat. Acad. Sci.*, **28**, 235; 1942) have utilized their X-ray mutant of *Neurospora crassa* to study the synthesis of *p*-amino-benzoic acid. The mutant strain is unable to synthesize the vitamin. When supplied with this vitamin the mutant strain grows at the same rate as normal and reacts like the normal strain when sulphanilamide is given to the medium. The mutant differs from the normal strain by a single gene unlinked with sex and situated far from the centromere. The gene is concerned with the synthesis of *p*-amino-benzoic acid and presumably influences a single synthetic process. It is concluded from tests with related substances that the bio-synthesis does not involve the introduction of an amino group into a preformed benzene ring.

### Genetics and Eye-movement

THE act of reading involves ocular shifts and pauses at each line of print. These can be recorded by instruments, and it is found that the pattern of the eye-movement is remarkably individualistic. By studying the eye-movement of twins H. E. Jones and D. H. Morgan (*J. Hered.*, **33**, 167–72; 1942) show that in addition to the habit differences in reading

induced by training there are inherited differences. Identical twins often show as close a similarity in eye-movement pattern as between two records of one individual, whereas classroom mates who have been trained alike and who are similar in reading ability show marked differences in specific aspects of eye-movement.

### Salivary Gland Chromosomes in Mosquitoes

EILEEN SUTTON (*Proc. Nat. Acad. Sci.*, **28**, 268; 1942) shows that salivary gland type chromosomes may be found in the Malphigian tubes of *Culex pipiens* and *Ædes ægypti*. There do not appear to be heterochromatic regions as in Drosophila but the banded regions could be mapped quite well. There is a well-marked nucleolus in *C. pipiens* but in *Ædes ægypti* it is only observed in early stages. The banding of the chromosomes is not present in the earlier stages, but the nucleic acid is accumulated in globules, after which the nucleic acid would appear to be redistributed to form the banded structure. It will be remembered that drastic treatment with Kodani's process gives the reverse effect—concentration of the nucleic acid from the banded parts into globules.

### Synthesis of Vitamins by Intestinal Bacteria

P. R. Burkholder and I. McVeigh (*Proc. Nat. Acad. Sci.*, **28**, 285; 1942) demonstrate that several bacteria normally living in the intestines of higher animals synthesize biotin, riboflavin, thiamin, and nicotinic acid when grown in media free from these vitamins. The bacteria studied were *Eschericia coli*, *Proteus vulgaris*, *Bacterium aerogenes*, *Alkaligenes fecalis*, *Bacillus mesentericus* and *B. vulgaris*. *P. vulgaris* appeared unable to synthesize nicotinic acid and *B. mesentericus* is deficient in biotin. The amount of vitamin produced at 36° C. was greater than required by the bacteria; it was found that 1–15 per cent of the biotin and nicotinic acid present in forty-eight hour cultures may occur outside the bacteria. The greatest synthesis of vitamins would appear to occur during the first fourteen hours of growth.

### Micro-determination of Calcium in Serum

THE procedure of Clark and Collip, which is widely used in clinical laboratories for the micro-determination of calcium in serum, is admittedly subject to a number of errors but was so designed that they should cancel one another. P. F. Holt and H. J. Callow, in a paper read to the Society of Public Analysts and other Analytical Chemists on October 7, find that such cancellation of errors does in fact occur provided the Clark-Collip procedure is strictly adhered to and the calcium content of the serum is normal. They describe a micro-procedure in which the errors are eliminated and which has the advantages of ease of manipulation, reduction in time of operation and applicability to smaller volumes of serum.

### Preparation and Analysis for Iron of Hæmin and Hæmoglobin

AFTER a short reference to the problem of standardizing estimations of hæmoglobin in blood, G. E. Delory, in a paper read to the Society of Public Analysts and other Analytical Chemists on October 7, described procedures for the preparation of, and estimation of iron in, hæmoglobin and hæmin. Two analytical methods were described. In one the sample is incinerated after being moistened with nitric acid, the ash is dissolved in hydrochloric acid and the iron titrated with titanous chloride solution. The other, based on the colorimetric method of R. W. Thorp, depends on measurement of the colour produced by the reduced iron with αα′-dipyridyl. A photo-electric colorimeter particularly suitable for the method was exhibited by Dr. E. J. King.

### Synthesis of Cellobiose

ALTHOUGH a synthesis of cellobiose was achieved by Freudenberg and Nagai in 1933 the yield was poor and there still remained the problem of obtaining a structurally definitive synthesis of the disaccharide. W. T. Haskins, R. M. Hann and C. S. Hudson (*J. Amer. Chem. Soc.*, **64**, 1289; 1942) have now prepared synthetic epi-cellobiose octa-acetate from products derived from D-mannose and D-glucose (both synthesized by Emil Fischer), and converted it into cellobial hexa-acetate, which on oxidation with perbenzoic acid gave chiefly cellobiose hexa-acetate; this product on acetylation gave a 63 per cent yield of a crystalline mixture of α- and β-cellobiose octa-acetates, from which crystalline cellobiose was obtained in quantitative yield by deacetylation. The overall yield was 35 per cent.

### 'Heavy' Adrenaline

DEUTERIUM (heavy hydrogen) has been used as an indicator in biological experiments with the assumption that the substitution for protium (light hydrogen) causes no change in physiological action, and this is probably correct, although Erlenmeyr and Lobeck in 1937 reported that acetylcholine bromide in which the acetyl hydrogens were replaced by deuterium became slightly less active. G. R. Clemo and G. A. Swan (*J. Chem. Soc.*, 395; 1942) have prepared 'heavy' *dl*-adrenaline from 'heavy' catechol of approximate formula $C_6HD_5O_2$ and chlorodideuteroacetic deuteracid, forming 'heavy' chloroacetocatechol, which with a solution of trideuteromethyldideuteramine in deuterium oxide gave 'heavy' *dl*-adrenaline containing 90 atoms per cent of D. Physiological tests showed an elevation of blood pressure almost indistinguishable from that produced by a similar amount of 'light' *dl*-adrenaline, the replacement of protium by deuterium in this case producing little (if any) change in the physiological action.

### Long-chain Acids containing a Quaternary Carbon Atom

BRANCHED-CHAIN fatty acids are scarce in natural products and those known are mostly related to terpenes. Oils of Hydnocarpus and related species, naphthenic acids from petroleum and fatty acids isolated from *Mycobacterium Lepræ* and *M. tuberculosis* (formerly regarded as toxins) are examples. A. J. Birch and Sir R. Robinson (*J. Chem. Soc.*, 488; 1942), who review previous work in the field, now describe the preparation of several acids containing a quaternary carbon atom, namely, trisubstituted acetic and propionic acids. The surface film behaviour of the substances and biological tests are only briefly reported. The synthetic methods, however, are fully described. Special attention was paid to the use of αα-dialkylsuccinic and ββ-dialkylglutaric acids as intermediates, and also to the application of the Michael reaction to appropriate αβ-unsaturated ketones. Some acids prepared were 2 : 2-dimethyl-lauric acid, 2 : 2-dimethylstearic acid, 1-methyl-1-*n*-octyldecoic acid, 3 : 3-dimethyl-tetradecoic acid, 5-keto-3 : 3-dimethyl-lauric acid and 2-phenacyl-2-methyl-lauric acid.

# EARTHQUAKES IN NEW ZEALAND

A VERY important review of New Zealand earthquakes by Dr. J. Henderson, director of the Geological Survey of New Zealand, and Mr. R. C. Hayes, acting-director of the Dominion Observatory, Wellington, New Zealand, has been issued*. Compared with other countries in which earthquakes are common, the frequency of earthquakes in New Zealand is relatively high. This is due to the occurrence of a large number of semi-destructive earthquakes and comparatively few major destructive earthquakes. During the years 1835–1934, there were 69 New Zealand earthquakes, of which 6 reached intensity 10 on the Rossi-Forel scale, 14 attained intensity 9 on the same scale, and the remainder were of smaller intensity. During the twenty years from 1921 until 1940 inclusive there has been an average of approximately 260 earthquakes felt in the islands each year, the average maximum intensity of the greatest shocks being rather more than 8 (semi-destructive) on the Rossi-Forel scale. During the year 1922 there were 1,187 earthquakes felt, but this abnormally large number was due to the Taupo earthquake swarm. The aftershocks of the Buller earthquake of June 17, 1929, also caused the total numbers in 1929 and 1930 to be greater than normal.

New Zealand may be divided roughly into four seismic regions :

(1) All areas of the North Island east and south of an approximate line from the vicinity of Whakatane in the Bay of Plenty to the vicinity of Hawera in South Taranaki, and all areas of the South Island north of an approximate line from the vicinity of Hokitika on the west coast, through the region of Lake Coleridge, to Banks Peninsula. During the years 1921–40 this region had an average of 97·8 earthquakes per year, 4·1 per decade of which were semi-destructive, and 1·7 per decade destructive (R.F. 9–10).

(2) South Auckland, western Bay of Plenty, Waikato, and Taranaki (except the southern portion). During the years 1921–40 there was an average of 23 earthquakes per year, of which 1·1 per decade were of intensity R.F. 8 (minor destructive) and there was none of greater intensity. The activity in this region tends to increase gradually towards the east and south, where it merges into region 1.

(3) Areas of the South Island, south of the boundary of region 1. In this region between 1921 and 1940 there were 12·1 earthquakes per year, of which 0·1 per decade were semi-destructive (R.F. 8), and none of greater intensity. Only one semi-destructive shock has been definitely recorded in this region (near Mount Cook), though early history suggests that heavy shocks occurred in the West Coast Sounds region in the years 1792, 1810, 1826–27. The eastern side is definitely less seismic than the western.

(4) Areas north of Auckland. In this region during the years 1921–1940 there was an average of 1·1 earthquakes per year, of which none reached intensity 8 on the Rossi-Forel scale. No destructive shocks have been known to occur in this region.

It is emphasized that these regions are approximate and that one region merges into its neighbours.

Taken in conjunction with the geology of New Zealand, the above facts are most instructive, and apart from the geology they can scarcely be comprehended. Earthquake and volcanic activity are manifestations of the adjustments constantly occurring in the earth's crust. Around the great sunken area of the Pacific there is a more or less continuous belt of geologically recent mountains, and this belt as a whole is subject to "chronic and acute seismicity". Earthquakes sometimes happen within the belt itself, though a large proportion have their epicentral areas on its submerged frontal slope. Dr. Henderson states that the South Island of New Zealand and the eastern part of the North Island are on the crest of the great mountain ridge or crustal fold which forms a portion of the real border of the Pacific. This ridge maintains a relatively straight course north-north-east for 1,600 miles across the floor of the Pacific, nearly to Samoa. The Auckland Peninsula, part of a decidedly weaker fold, meets the main fold nearly at right angles in the Rotorua-Taupo volcanic region. The earthquakes of this seismically sensitive district, though they may be locally severe, are not usually felt far from their points of origin. On the other hand, the tectonic earthquakes that occur along the main earth-fold shake large areas, some of them being recorded on instruments throughout the world. These are caused by slipping of earth-blocks against their neighbours along fractures.

Many great fault-zones have been traced for long distances, but a few only have been active since European occupation. The Hawke's Bay earthquake of 1931 raised an area 60 miles long and in parts 10 miles wide in a north-east direction. The uplift was greatest along the south-east edge of the area, for miles amounting to 6 ft. or more. Numerous levels on the Heretaunga Plain and along the railway north of Napier showed that the uplift decreased north-westward, so that the area was slightly tilted in that direction. The ground east of the uplifted area sank, and parts of the Napier and Wairoa flats are more than a foot lower than before the earthquake.

In 1929, movement along a north-trending fault seven miles west of Murchison raised the ground east of the fault by about 15 ft., and caused it to shift north-west by about 9 ft. The uplift gradually decreased eastward and died out sixteen miles from the fault, facts indicating a slight tilt of the earth-block towards the east. Subsequent levellings showed that the block was sinking somewhat irregularly, a movement, no doubt, which caused some of the innumerable local after-shocks felt in the area over many months after the main shock.

Other sensible earth-movements occurred in connexion with the Taupo earthquake series of 1922, the Amuri earthquake of 1888, the Wellington earthquake of 1855, and probably the Awatere earthquake of 1848. There is also definite evidence of geologically recent differential movement of earth-blocks at several widely separated points in both Islands. Seismographs situated at Wellington, Auckland, Christchurch, Arapuni and New Plymouth registered four strong distant earthquakes during July 1942 (Provisional Bulletin, No. P 125). These were on July 7, 8, 25 and 29. Additionally there were nineteen sensible shocks in the islands, none being greater than intensity 4 on the Rossi-Forel scale. The greatest of these was on July 26 and was felt with intensity 4 (R.F.) in the western areas of North Island and the northern parts of the South Island.

* "Earthquakes in New Zealand". Dominion Observatory, Wellington, W.1, New Zealand. Bulletin No. S. 63, extracted from the "New Zealand Official Year-Book, 1942".

## SOCIAL BIOLOGY IN EDUCATION

A CONFERENCE on the place of social biology in education was held by the British Social Hygiene Council at Tavistock House, London, W.C.1, on October 24.

Sir Cyril Norwood, giving the presidential address, made no claim to be a biologist, but stated that during his forty years of educational work he had been increasingly impressed by the importance of biology in education. One of the implications of social biology is that sex education should be regarded as a normal part of the school curriculum. Sir Cyril made some chastening remarks about those who see the solution in the making of biology a compulsory subject in the School Certificate, remarking that he has a list of at least fourteen subjects which could make a similar claim. Further, deploring the fact of the ridiculously high standards of the university scholarships examinations and referring to the method of selection of sixth-form biologists, he emphasized that primary school pupils, being by far the most numerous, constitute the most important aspect of the problem. New advance after the War will inevitably be a matter of decades, particularly in view of the fact that a hundred thousand extra teachers will have to be found and trained. In this connexion the universities will have to face up to their responsibility in the training of teachers, especially by the provision of general honours courses, including biology and social science with a biological basis.

Later in the morning Mr. W. L. Sumner spoke on "Social Biology Now and in the Future". Referring to the annual decline taking place in the mean national intelligence quotient, he mentioned the need for considering eugenic measures. He pointed out that biologists to-day have sufficient knowledge to enable them to produce a biscuit containing adequate vitamins and minerals to satisfy daily needs, but in this as in other respects it is the economic application of biological knowledge that is faulty. In subsequent discussion Mr. David Jordan pointed out the need for democracy in the functioning of the school. Miss Taylor emphasized the importance of habit formation in the primary school, followed by a well-integrated general science course in post-primary schools. Other speakers referred to the results of the application of biological knowledge in the U.S.S.R. and the need for providing the people of Great Britain with an ideal for which they will feel enthusiasm.

The afternoon session was opened by an address by Sir John Graham-Kerr. He gave an account of the life among the South American Indians of the Gran Chaco. He sketched their system of education, including education through the years of adolescence in preparation for adult life. The alertness which is the constant condition of primitive man contrasts very markedly with the unthinking automatism of the product of modern education. He pointed out that the mere indiscriminate collection of facts is no more science than the heaping up of bricks is architecture, and stressed the importance of intermingling poetry and imagination with the accurate establishment of fact. The muscular performance of a skilled craftsman is just as much a manifestation of 'brain power' as is the production of the most erudite thesis. He deprecated the common tendency to regard manual work as in some way inferior to mental.

Mrs. E. J. Hatfield opened a discussion on "Social Biology for Teachers in Training", by stating that German university students in Munich and Nuremberg before the War of 1914–18 had no critical faculty whatsoever, and that she does not know of any educational system better than the English. In making plans for post-war training of teachers much thought must be given to the majority of the profession, namely, those who were trained many years ago. This would involve refresher courses lasting for at least a term, with full salary during attendance, in addition to the shorter refresher courses at frequent intervals. It has been her impression while lecturing that a training college student has, in general, a far greater social sense than the academic graduate teacher in the secondary school. The subject of hygiene in the training college, which is compulsory for all students, should include the fundamentals of biology together with its social implications, and in the universities there should be a social biology course for all graduates who intend to take up teaching.

In the discussion which followed, Miss Warden confessed an inability to understand exactly what is meant by the phrase 'social biology', but made a plea for greater co-operation between the medical and teaching professions, particularly in the provision of specialist knowledge on medicine to teachers and on education to medical people. Later in the afternoon Mr. C. Bibby mentioned that in January the Central Council for Health Education would be publishing the first number of a quarterly journal, *Health Education*, to meet precisely this need.

The evening session on "Our Responsibility for Human Quality in the Colonial Empire" was opened by Sir Francis Fremantle, giving population statistics from various countries. He quoted various conditional forecasts of population trends and mentioned that the real cause of the decline in the birth-rate is the decay of moral authority of parents, teachers and religion together with the fundamental economic conditions of acquisitive society. The Maoris were given as an example of recovery after apparently inevitable extinction, and the depopulation of Melanesia as a warning of what can happen when white men interfere with native methods of life.

---

## PLANKTON OF THE NORTH SEA*

PHYTOPLANKTON of the North Sea is being investigated very thoroughly by examination of the continuous plankton records collected by the Oceanographical Department in the University of Hull. Earlier results were published in the Department's *Bulletin* in 1940 (for the years 1932–37), and the Diatoms for 1938–39, corresponding to the present part, in 1941. The distribution of the Dinoflagellates and Phæocystis in general provides further evidence of the points made in the preceding diatom paper. A picture has gradually been growing of the distribution of the phytoplankton in the area investigated, at first only in the north, later in the central and southern North Sea. Six extra steamship lines were run monthly: from Hull to Oslo, from Leith to Hamburg, Copenhagen and Lerwick, and from Pentland Firth to Hamburg and Bergen. In addition, records were obtained from the Faeroe Shetland Channel in 1939, the route crossing the southern entrance to the Faeroe–Shetland Channel

* Phytoplankton of the North Sea, 1938–39. Part II.—Dinoflagellates, Phæocystis, etc., by C. E. Lucas. The Faeroe-Shetland Channel, 1939, by C. E. Lucas, N. B. Marshall and C. B. Reer. *Hull Bulletins of Marine Ecology*, edited by A. C. Hardy and C. E. Lucas, Nos. 9 and 10, 2, pp. 47–94. Plates XXXIX–LXII. April, 1942. 8s.

and stopping some hundred miles past the Faeroe Bank. It is most unfortunate that all these valuable activities have necessarily been stopped by the War.

This later dinoflagellate work differs from the previous reports in dealing to a certain extent with the separate species of Ceratium. *Ceratium fusus* is the most important of these, is usually much the most numerous and tends to determine the apparent distribution of the genus. At times it forms almost 'pure' communities. Increase in Dinoflagellates always follows that of the Diatoms. Phæocystis is usually abundant when there are fewer Diatoms and Dinoflagellates. The importance of 'patchiness' in all three groups is emphasized and also the rapid numerical change in relatively short time and space intervals. In the southern area between 1932–37 and 1938–39 it is found that after increasing until 1937 or 1938, the Diatoms and Dinoflagellates were much scarcer in 1938 and/or 1939, but Phæocystis was scarcer from 1934 until 1937 and increased again during 1938–39. On the whole, the flagellate data provide confirmatory evidence for the cycle of changes since 1932 which were first deduced from the diatom record up to 1937 and 1939, and have already received some confirmation from the zooplankton for the earlier period.

The persistence of the two large areas of dinoflagellate production in the north-west and south-east provides even better evidence than in the Diatoms of the general agreement between the adjacent and intersecting recorder lines.

It is very interesting that there are signs of relationship between the distribution of some of the Dinoflagellates in the north-western area and that of *Sagitta elegans elegans*, and this seems to point to a possible association between the organisms found in this area and the Atlantic influence that may be extended there. The north-western area corresponds broadly with Russell's (1939) area of "*elegans* water" and the south-eastern to his area of "coastal water". The distribution shown of the Ceratium species together with the Diatoms may possibly be associated with signs of an increased flow of (possibly phosphate scarce) water into the area from the English Channel after the early months of 1938. More evidence is provided suggesting that the phytoplankton-productive water of the preceding years may have moved out of the area in a northerly or north-easterly direction.

The results of the Faeroe-Shetland Channel line are very suggestive but much more data are required to bring the work into line with the rest. They do, however, provide for the first time a series of continuous records at fairly short intervals from spring to midsummer, and form a basis for future work.

## FORTHCOMING EVENTS

*(Meeting marked with an asterisk is open to the public)*

### Saturday, November 7

BIOCHEMICAL SOCIETY (in the Department of Organic Chemistry, Imperial College of Science and Technology, South Kensington, London, S.W.7), at 11 a.m.: Discussion on "The Theory and Application of Chromatographic Methods to Biological Problems".

### Saturday–Sunday, November 7–8

ASSOCIATION OF SPECIAL LIBRARIES AND INFORMATION BUREAUX (at the Royal Society, Burlington House, Piccadilly, London, W.1).

Saturday

At 11 a.m.: Annual General Meeting. At 12 noon: Sir Richard Gregory, Bart, F.R.S.: "International Systems and Standards".

Sunday

At 10.30 a.m.: Symposium on Microfilm.

### Monday, November 9

FARMERS' CLUB (at the Royal Empire Society, Craven Street, London, W.C.2), at 2.30 p.m.—Dr. H. I. Moore: "The Cropping Problem of To-day".

ROYAL GEOGRAPHICAL SOCIETY (at Kensington Gore, London, S.W.7), at 5 p.m.—Capt. R. C. Farrow: "Forecasting Run-off from Snow Surfaces".

### Tuesday, November 10

ROYAL INSTITUTION (at 21 Albemarle Street, London, W.1), at 3 p.m.—Sir James Jeans, O.M., F.R.S.: "Evolution in Astronomy", 2.*

ASSOCIATION OF SCIENTIFIC WORKERS (at the Royal Photographic Society, 16 Princes Gate, South Kensington, London, S.W.7), at 6.30 p.m.—Projection of the Cine Films entered for the Exhibition of "Photography in Science and Industry".

### Wednesday, November 11

ROYAL SOCIETY OF ARTS (at John Adam Street, Adelphi, London, W.C.2), at 1.45 p.m.—Prof. A. W. Ashby: "Agriculture To-day and To-morrow", 1: "Efficiency and Output in Agricultural Systems".

### Thursday, November 12

INSTITUTE OF FUEL (at the Connaught Rooms, Great Queen Street, London, W.C.2), at 2.30 p.m.—Dr. G. E. Foxwell: "The Provision of Smokeless Fuel for Post-War Reconstruction".

PHARMACEUTICAL SOCIETY (at Friends House, Euston Road, London, N.W.1), at 2.30 p.m.—Prof. J. C. Drummond: "Nutrition".

### Friday, November 13

ASSOCIATION OF SCIENTIFIC WORKERS (at the Royal Photographic Society, 16 Princes Gate, South Kensington, London, S.W.7), at 6.30 p.m.—Dr. H. Mandiwall: "Technical Cinematography in Colour".

### Saturday, November 14

GEOLOGISTS' ASSOCIATION (at the Geological Society, Burlington House, Piccadilly, London, W.1), at 2.30 p.m.—Mr. C. E. N. Bromehead: "The Early History of Water Supply".

## APPOINTMENTS VACANT

APPLICATIONS are invited for the following appointments on or before the dates mentioned:

TEACHER OF GENERAL SCIENCE SUBJECTS, and a TEACHER OF ENGINEERING SUBJECTS—The Principal, Luton Technical College, Luton, Beds. (November 12).

SPEECH THERAPIST TO THE ISLE OF ELY COUNTY COUNCIL EDUCATION COMMITTEE—The School Medical Officer, County Hall, March, Cambs. (November 12).

LECTURER IN CHEMISTRY AT THE HULL MUNICIPAL TECHNICAL COLLEGE, CHIEFLY FOR INORGANIC CHEMISTRY—The Director of Education, Guildhall, Hull (November 16).

HEADMASTER OF THE GUILDFORD JUNIOR TECHNICAL SCHOOL—The Chief Education Officer, County Hall, Kingston-upon-Thames (November 17).

BIOCHEMIST FOR RESEARCH WORK OF NATIONAL IMPORTANCE IN THE DEPARTMENT OF PHYSIOLOGY AND BIOCHEMISTRY—The Secretary, National Institute for Research in Dairying, Shinfield, Reading.

LECTURER-IN-CHARGE OF CHEMISTRY—The Principal, Handsworth Technical College, Golds Hill Road, Handsworth, Birmingham 21.

LECTURER ON WORKS ORGANIZATION AND MANAGEMENT—The Principal, West Ham Municipal College, Romford Road, Stratford, London, E.15.

ASSISTANT MASTER TO TEACH SCIENCE AND MATHEMATICS IN THE JUNIOR TECHNICAL SCHOOL FOR THE BUILDING INDUSTRY—The Director of Education, Education Office, South Parade, Nottingham.

TWO INSTRUCTORS FOR DAY CLASSES FOR TRAINING OF MARINE ENGINEERS, at the Stow College, School of Engineering—The Director of Education, 129 Bath Street, Glasgow, C.2 (November 20).

GRADUATE WITH GOOD HONOURS DEGREE, FOR STATISTICAL RESEARCH—The Secretary, Rothamsted Experimental Station, Harpenden, Herts.

## REPORTS and other PUBLICATIONS

*(not included in the monthly Books Supplement)*

### Catalogues

A Catalogue of Books and Periodicals on Astronomy, Chemistry, Electricity, Engineering, Mathematics, Mining, Navigation, Physics, etc. (No. 603.) Pp. 32. (London: Bernard Quaritch, Ltd.)

Catalogue of Lewis's Medical and Scientific Lending Library, Supplement 1938–1941. Pp. 168. (London: H. K. Lewis and Co., Ltd.) 4s. net (to Subscribers, 2s. net).

Old Science and Medicine, Early Photography. (Catalogue 68.) Pp. 49. (London: E. P. Goldschmidt and Co., Ltd.)

Cambridge Polarograph (Heyrovsky Pattern) for Micro-Analysis. (List No. 109.) Pp. 36. (London: Cambridge Instrument Co., Ltd.)

Radiology: the Library of a leading British authority on the subject of Radiology, Röntgenology and kindred Sciences. Pp. 12. (London: The Museum Book Store, Ltd.)

Easy-Flo Silver Brazing Alloy. (Publication 122.) Pp. 4. (London: Johnson, Matthey and Co., Ltd.)